Australian Personal Computer

APPLE II GAMES REVIEWED

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DRIVING YOUR COMPUTING DOLLAR FURTHER:
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13 July 1982

RECEIVED 15 JUL 1982

Mr S Howard
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Vic 3122

Dear Sean,

As you know, for nearly 10 years I have been involved in the establishment of new exhibitions in a variety of locations ranging from New York to Bahrain. I can honestly say that I have never experienced such a positive response to the announcement of a new show as I have with The 1st Australian Personal Computer Show. No doubt at least part of this response can be attributed to the sponsorship provided by your Australian Personal Computer magazine.

Since launching the exhibition on 21 May 1982 with a selective mailing to both Australian and overseas companies we have received what I can only describe as a remarkable response. Nearly every major name in the personal computer field has applied for a stand in the exhibition. With more than 7 months before the show takes place, we are in the extremely strong position of having allocated precisely 76 per cent of the available space at Centrepoint.

Yesterday I briefed the designer to prepare plans for the Grand Hall Balcony. By using the Balcony, which I previously thought would be well in excess of our requirements, we shall be able to offer a further 270 square metres of good quality exhibition space, making a total area of more than 1,700 square metres (17,136 square feet).

There is little doubt in my mind that we are well on the way to staging a highly successful event. Having received what amounts to unqualified support for the exhibition it is imperative that our buyer promotion campaign produces the right buyers in the right numbers for the exhibition. I shall look forward to finalising our promotional plans with you when we next meet.

Kind regards

Graeme

Graeme Selby
Director

1079L

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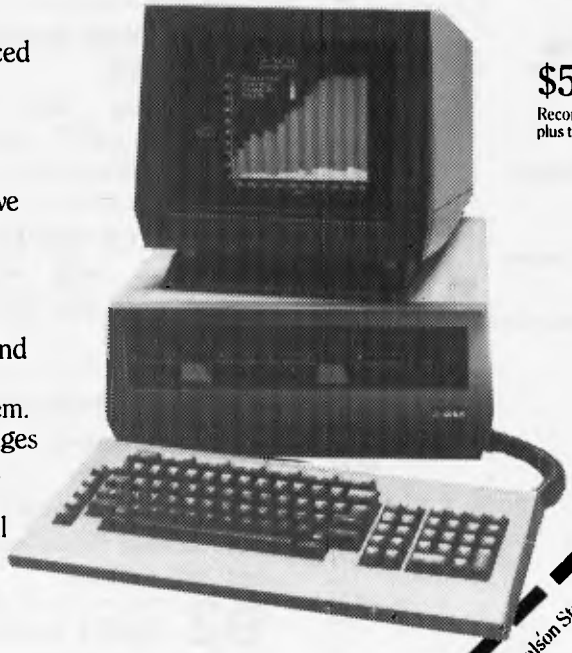

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To Barson Computers Pty. Limited, 86 Nicholson Street, Abbotsford, Vic., 3067
Please send me more details about Sirius 1

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Company
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1079R

inside

ADVERTISERS INDEX

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Volume 3 No. 7 1982

APC

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oft.*

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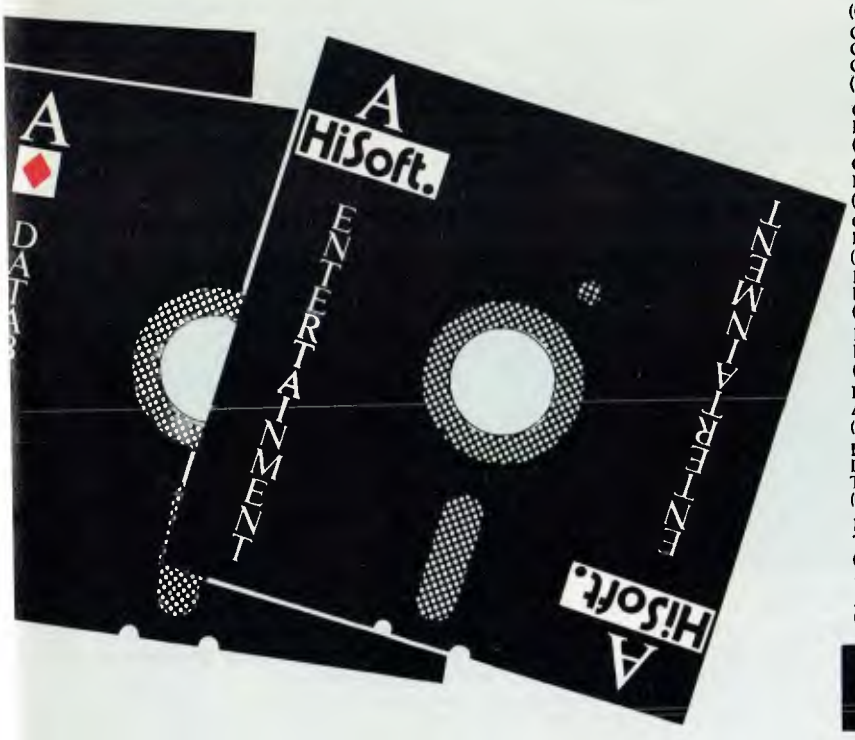

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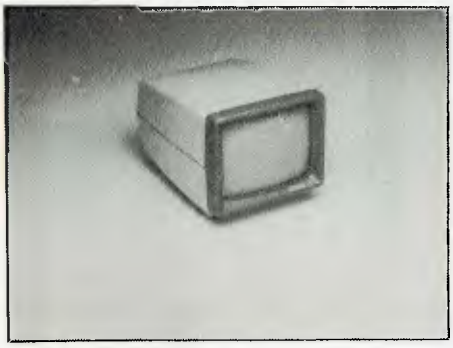

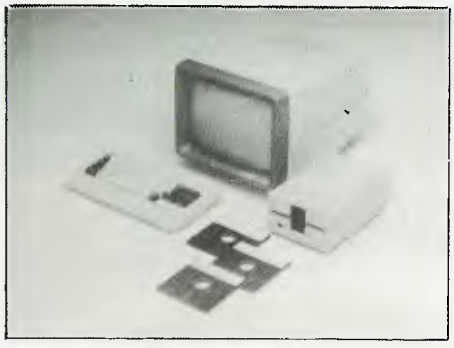

Cromemco C-10

Elsewhere on this page is our first photograph of Cromemco's new personal computer range called C-10 and mentioned last month in Printout. Three configurations are shown, the first, at US$995, being the basic unit comprising processor (Z80A), 64k of RAM, a hefty 24k of ROM and a VDU. The next level is priced at US$1785 and includes a keyboard, 390kbyte capacity 5¼in floppy drive and an estimated US$1000 worth of software. The last configuration shown has additionally a 12.5 cps daisy-wheel printer and swivel stand for the VDU and sells for a total price of US$2875.

Of particular interest is the cheapness of the printer which must be valued at around a thousand dollars, at a quick calculation.

Mr Gatt of Adaptive Electronics says the most popular configuration for the C-10 should be the special Super Pack referred to as the C-10SP. This system configuration consists of the basic C-10 keyboard, 390k capacity 5¼in floppy drive, along with a CP/M compatible operating system, 32k structured Basic, word processing and financial spread sheet software.

Australian prices have yet to be announced but the second level configuration will sell in Australia for approximately $2500 (including software).

For more information phone Adaptive Electronics on (03) 267 6800.

Compak V2

Following the successful response to their fully built up System and their new Apple-compatible slimline 5 inch disk drives, the Compak Computer Shops are again adding to their Apple compatible range.

New products now include the SVA 8 inch disk controllers, 256k byte of Cache memory with dual disk simulation, and a new range of interface cards.

Most significant though is the planned introduction of their Compak V2 system which will run all Apple software. Their Orange system will continue and will be priced about two hundred dollars under the Compak V2 system.

This will give them three price breaks – from the low priced Orange up to the standard Apple pricing.

For more information contact Compak Computer Shops at Brighton (03) 592 8343 or Dandenong (03) 793 5701.

Sutherland Revisited

The birthplace of Australia, Sutherland Shire, has now entered the computer age with the advent of The Computer Connection of 629 The Kingsway, Miranda. When Capt James Cook landed in the shire at Kurnell on Botany Bay, he could not have envisaged the size and complexity of today's Sutherland Shire.

The population of the shire, which now numbers 170,000, covers the whole spectrum from large companies to families and The Computer Connection endeavours (pun intended) to cater to all their requirements in this modern computer age.

Franchises available include Apple, Atari, Osborne, Panasonic, T.I., and the many peripherals and programs available for these products. Tim Harvey, the proprietor, has been active in helping the local schools to bring computer knowledge to the many children in the shire – essential for their future.

Some of their clients have been scientific people from the Lucas Heights Atomic Research Station and the C.S.I.R.O. at Cronulla, as well as businessmen, teachers, students, hobbyists and families wanting to learn about the wonders of computers.

Earlier this year Tim arranged for the Federal, State and local government members to be present whilst they communicated with Sutherland's sister city Lakewood, Colorado, U.S.A. via The Source.

Pictured is Geelong's newest and most prestigious micro store, The Computer Centre. Damar Management are responsible for the construction of the building, situated across the road from a planned major shopping development. The store, at 5 Yarra Street, was officially opened on July 7 at a reception which prominently featured Hewlett Packard and Barson Computer representatives, and will be retailing (naturally enough) the new Sirius 1 microcomputer and a range of Hewlett Packard machines. APC wishes Damar well with their venture.

PRINTOUT

Euro show

Everybody goes to the NCC, the National Computing Conference, in America each year. It is a zoo: in Houston this year a record number of people failed to see the 'new' products which had already appeared at the Hanover Fair.

If you must blow all the company's budget going to look at computing equipment, consider instead Comdex. You've just missed Comdex in Atlantic City but there is going to be one in Europe, 8–11 November, in Amsterdam. And after that, one in Las Vegas, 29 November to 2 December.

For no good reason, the very new Comdex shows seem to attract the more important announcements – the Sirius 1 for instance, was announced at last year's winter Comdex.

Quite what the Amsterdam one will be like, nobody can say, because it is the first but already, says the organising company, Interface Group, companies like Altos, Cii Honeywell Bull, Corvus, DEC, Micom, Onyx, Osborne, Ramtek, Tandon, Televideo and Universal, Vector Graphic and Zenith are coming.

Details from Comdex, 160 Speen Street, PO Box 927, Framingham, MA 01701, USA.

"Smart" printer range

The first two products in a new range of intelligent matrix printers have been released to the Australian market by CASE Communication Systems. Manufactured for CASE in the UK, the initial range constitutes the BD 136 with 240 cps capability and the WM 2000 with a speed of 120 cps.

Both printers offer a bi-directional logic seeking mechanism for maximum throughput speed and to minimise printhead movement.

A 9 x 9 dot matrix provides high quality print and the ballistic printhead has proven to give reliable long-life, according to CASE.

Both units include dot addressable and character graphics as well as user programmable characters. The BD 136 has an alternative 96 character set, user-definable and capable of printing with a resolution of 60 dots per inch horizontally and 72 per inch vertically. Large buffers are standard features of both machines, with 10,000 characters on the BD 136 and a possible 1800 on the WM 2000.

The BD 136's data formatting functions include centre justification, shift to right margin, decimal point and comma alignment, underlining, expanded characters, proportional spacing and right margin justification.

Other features include full forms control with horizontal and vertical tabbing, and the ability to define additional non-standard characters as well as down loading complete character sets.

Interfaces available with both models include Centronics parallel, RS 232, Current Loop and IEEE.

The introduction of the new range of printers, to be augmented in the near future, marks a move by CASE to enter larger market segments than currently covered by its CX 80 colour matrix model, managing director Barry Foster said.

Opening in Perth

Computer Choice, a franchise of the Computer Country group of Melbourne, has opened in Perth.

Computer Choice is now offering a wide range of microcomputer systems which includes the Apple, the Hitachi Peach, the Osborne, the NEC PC-8000, the Atari, the Northstar, Micromation, CEC, Casio FX 9000P, and OKI IF 800. Besides having hardware and software for the previously mentioned systems, Computer Choice will also be offering software and peripherals for systems such as the TRS 80.

Computer Choice is a full service company which not only offers both hardware and software sales and consulting abilities, but also offers after sales service.

Computer Choice has also been appointed the prime Western Australian dealer for the Australian Beginning system. Australian Beginning is Australia's first microcomputer information service. Computer Choice will have responsibility for servicing all Australian Beginning accounts in Western Australia as well as holding periodical seminars for Western Australian users of the Australian Beginning system.

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■ 32K RAM

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These seminars will acquaint Western Australian users with new services as they eventuate and also show Australian Beginning users how to get the most out of their system.

Computer Choice is situated at 1297 Hay Street, West Perth WA 6005, ph: (09) 322 5651.

No CP/M-68K this year

Most people seem to be coming round to the idea that the operating system we will all use on machines that have a Motorola 68000 chip inside, will be something called Unix; it is already available on a machine called the Fortune 32, recently announced in the UK by its US parent.

Guess who, then, reckons that 'we feel that the CP/M-68K will become a standard operating system for 68000-based microcomputers and that our working relationship with Hitachi will expediate the availability of CP/M-68K'?

It's Tom Rolander, Digital Research's vice president in charge of the operating systems division. The reference to Hitachi is because Digital Research will be working with that company in developing the operating software. The two companies also 'expect to develop several application languages' for the chip.

The only deduction that can be made from the announcement is that CP/M-68K will not be available on any 68000 system this year. Tom Rolander can be as optimistic as he is paid to be about making a standard out of it; the rest of us will just have to wait and see.

At last

The cover story of the March, 1981 issue of *APC* proclaimed the arrival of the first commercially available code generating program. And now in July '82 we're pleased to announce the Australian launch of "The Last One".

Without going into any details about the program (refer to the "Back Issues" section for an order form for March '81), it is available from System Concepts, (09) 381 5611 for $600.

Computer insurance

Computer Country has announced what it calls an "incredible new insurance policy against computer breakdown".

Computer Country has now combined with David Hornidge Insurances of 422 Collins Street, Melbourne to provide a new insurance policy for computer owners against accidental damage and breakdown.

For an annual premium of $135 customers are automatically covered for accidental damage and breakdown of a computer system which includes software. The policy includes the full cost of repair or, in the event of total loss, complete replacement of the system. There is an excess clause in this policy which means that the first $100 in each claim must be paid by the insured. Information is available from David Hornidge Insurances, ph: (03) 67 8583, or through any Computer Country franchise office. Any repairs or replacement occurring under the policy can be done through Computer Country.

Shrinking disks

When you and I get to buy a disk, it costs two or three or even four times what it costs to buy it in large batches from the factory but even so, the new factory price of around $120 for a two-thirds height minifloppy from Shugart would mean that microsystems should soon get a bit cheaper as well as a bit smaller.

It will be more impressive when half-height drives come down to this price. Those of us with one disk would then be able to get two instead, and squeeze them both into the same box. And those of us who have two already could of course replace one with a hard disk, and the other with two half-height floppies. Still, it's a start.

Shugart announced this product in May: one can safely predict that some of these will find their way into boxes in the shops before the beginning of next year.

Cycom service

Cycom Computer Systems has introduced a unique service to assist with the evaluation of CP/M software.

The company has demonstrated versions of popular software packages for hire. These packages include data base managers, word processors, spelling verifiers, critical path analysers, financial modellers, medical and office management systems and an application development language.

All hiring charges may be applied to the cost of the package if it is subsequently purchased from Cycom, which is located at 178 High Street, Windsor, 3181. Telephone: (03) 529 3029.

Micro software battle

Computer Power's Micro-Products software range is aiming to replace CP/M as the business system software standard for microcomputers. Probably better known by its former name of MicroCobol, the software system is now available on nearly 50 different computers.

Authors of the product range, MicroProducts Software Ltd., (MPS) of London, released an improved version of its Business Operating System (BOS/5) about seven months ago. This is now installed in nearly 100 user sites in Australia.

Joint effort

The Australian Beginning and Sigma Data Corporation have combined to offer a new low cost computer equipment package, from as low as $20 a week, to enable computer users to have the services of The Australian Beginning computer network.

This computer package will include a cheap, easy to operate desk top terminal, an acoustic coupler, an Australian Beginning lifetime membership, and a prepaid block of 60 computing hours.

The package will be available for around $20 a week over 5 years.

The Australian Beginning is closely linked to a Melbourne retailing group, Computer Country.

The Big Event!

The Big Event is scheduled for March 10 – 12, 1983. What, you may ask, is the Big Event?

The Big Event is the 1st Australian Personal Computer Show, sponsored by APC. The exhibition, which will be held at Sydney's Centrepoint, will display the wares of those competing for a share of the multi-million dollar Australian personal computer market.

Following recent displays staged by both Apple and Tandy, it is hardly surprising

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that a large scale specialised exhibition is being planned for the personal computer market. Now, in one visit, at one location and at one single exhibition, businessmen, professional people, educationalists and home users will have the opportunity to see and compare the largest and most comprehensive display of personal computer hardware, accessories, software, literature and services ever assembled in Australia. Isn't it enough to make you shiver with anticipation!

In an industry characterised by rapid technological development and frequent new product announcements, The 1st Australian Personal Computer Show will provide manufacturers, importers, distributors and retailers with a firm base for marketing their products and services to an audience estimated to be worth in excess of $50 million per annum. This, of course, includes APC's beloved readership.

The 1st Australian Personal Computer Show has impressive credentials. It is organised by the international management team responsible for Europe's largest and most successful microcomputer exhibition, The Personal Computer World Show. It is sponsored by APC, which, as you know, is the leading personal computer publication in this country, and its sister publication, Australian Business Computer. We will bring you more news on this Australian "first" in coming months.

Further details on the exhibition are available from Australian Exhibition Services Pty Ltd, 1250 Malvern Road, Malvern, Victoria, Australia 3144; Tel: (03) 20 1208. Telex: AA 39329.

Storage story

Durango Systems has released what it calls the first desk top system featuring a fully integrated winchester disk drive.

The Durango 900 series offers up to 15Mb of online storage, with an auxiliary disk drive adding another seven or 14 Mb.

The new series consists of two models, the 900 and 900XR, the difference being the printer. For data processing and internal correspondence, the 900 provides bidirectional dot matrix printing at up to 200cps. The 900XR has a dual mode printer with a high resolution mode for letter quality printing.

The processor has built-in diagnostics and error detection; and user memory is expandable from a standard 64k to 196k.

Two types of disk are used. Applications programs reside on a single 5¼ inch floppy with one Mb of capacity. Mass storage of information is on a "micro-winchester", with a capacity of seven or 14 Mb.

Durango is at 21 Chapel Street, Marrickville, NSW 2204; Tel: (02) 517 1300.

New DS Modem

Dick Smith Electronics has released a new product – one which it expects to trigger off an enormous surge in data communications in Australia. Called the "Dataphone", the new unit is a high performance data modem which will sell for less than half the price of any modem currently available in Australia.

As entrepreneur Dick Smith explains, his company decided to develop the new low-cost modem because they realised existing modems were far too expensive to be of interest to the growing army of personal computer owners:

"Until now, people have had only two choices. One was to lease a modem from Telecom, but this costs about $800 a year. This is more than the price of many personal computers! The other option was to buy an acoustic-coupling modem – but these still cost around $400 – far too expensive. It was obvious that the communications revolution wasn't going to get under way in Australia until people could buy a really low cost modem. So we decided to make it happen!"

The new Dataphone modem is not an acoustic coupled type, but a directly connected modem which offers full duplex operation at the standard 300-baud switched-network communications rate. It has been designed by DSE's technical director Jim Rowe.

As Jim Rowe explains, he selected the direct-connect approach for the Dataphone because it offered the only way to achieve high performance and reliability at low price:

"The problem with acoustic couplers is that no matter how good they are, the end result still depends heavily on the rather antiquated carbon-

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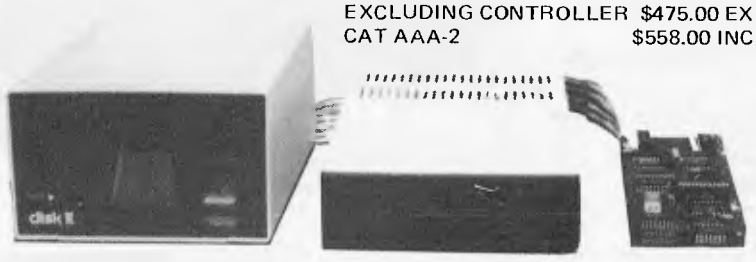

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The only problem was that when DSE began work on the Dataphone, Telecom Australia were not yet prepared to accept privately-owned direct connect modems of the discrete type, for authorisation as a "Permitted Attachment", so DSE began negotiating with Telecom in parallel with the technical development, to see if official policy could be updated. This two-pronged approach paid off, because the Dataphone became the first – and currently the only – direct-connect discrete modem to be given Telecom authorisation.

Some of the features claimed are:

* Designed and manufactured in Australia
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* Fully complies with both Telecom regulations and CCITT Recommendation V.21 – hence it is not only legal, but also fully compatible with other standard modems. (Telecom Authorisation No. C82/37/557)
* Operates in either Answer or Originate mode.
* Has a Phone/Modem switch.
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The Dataphone modem is priced at a low $169.00 retail at all DS stores.

See "New DS Modem".

BBC Chosen

The Acorn BBC Microcomputer has been selected by the Education Department of Western Australia as the only equipment which may be purchased with Government funding assistance by Primary Schools.

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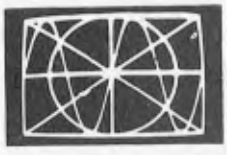

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(CAI) the Department, supported by the W.A. Government Computing Policy Committee, has specified the BBC microcomputer as "the best available computer" for that need.

The minimum configuration Model A computer, which costs $1150, has 16k of user memory, a 16k operating system plus a 16k structured Basic and assembler. The user memory can be expanded to 32k, while up to 48k of software in read only memory (ROM) may be added. Programs may also be loaded via the speech synthesiser ROM sockets. The high quality keyboard includes ten programmable function keys and excellent editing facilities. High quality colour graphics are included and disks, complete with a powerful disk operating system, are available.

The Model B computer sells for $1450 and may be expanded to support a variety of operating systems including CP/M in one of it's multiprocessor configurations.

As well as supporting RGB and composite video colour monitors, the BBC Microcomputer can interface to a domestic TV set, RS232 compatible devices, teletext receiver, analogue devices and the Acorn Econet Local Area Network.

For more information phone Barson Computers, (03) 419 3033 or visit BBJ Computer Shop.

Pictured here is the ICL Personal Computer Model 6402.

ICL Micro

International Computers have released the ICL Personal Computer which is available in four different models.

The basic entry level machine is the Model 10 equipped with 64k bytes of RAM memory, twin 500k minifloppy disk drives and two I/O ports for peripherals.

The largest model in the range is the Model 32 which comes with 256k bytes of RAM, a 5 megabyte Winchester fixed disk, 500k bytes of minifloppy storage and eight I/O ports. All the ports are standard RS232C compatible. Matrix and correspondence printers may be attached to the system.

The visual display unit is a 30cm diagonal green screen, has a moveable keyboard and an extensive array of function keys to support such applications as word processing.

The machine runs under CP/M and MP/M-2 will be introduced in August, both of which support Microfocus Cobol and Microsoft Basic.

It will be sold through Traderpoint dealers at a basic price of $7,000.

Mr David Dearman, corporate marketing manager of ICL, said: "Although the personal computer market is highly competitive, we believe we have a winner with the ICL Personal Computer. It is one of the few micros around with working 5 megabyte Winchester disks.

"Being a true multi-screen system the ICL Personal Computer is well placed to capture the multiple user segment of the micro computer market, particularly as it is able to support two printers.

"One user may be using the machine for processing data while another may be using the word processing facilities.

"Quite apart from the technicalities of the machine, buyers of the ICL Personal Computer will have the benefit of extensive ICL back up. We have offices Australia wide which are ready to provide engineering and technical support."

For more information contact International Computers Limited in Sydney on (02) 438 4440, or Melbourne on (03) 267 2433.

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See MultiShare System.

Multishare system

Dicker Data Projects introduced its largest microcomputer system to date — a multi-user, multitasking 32 Megabyte Winchester disk system that can support up to five workstations.

Designated the 5032 MultiShare, the system's new features include a 6MHz Z-80B processor which speeds up processing time by 15 to 25 percent over a 4 Mhz system, and RAM memory expanded to 128k which provides 56k per terminal for user applications and still leaves room for a new and extended version of a CP/M operating system.

The 5032 MultiShare System utilises a 32-megabyte 8-inch Winchester hard disk which provides 32 million characters of storage. Business software written for the 5032 can handle the largest files allowed by the CP/M system — 8 million characters in length, which also makes it the ideal system choice for developers of custom applications software, according to Fiona Dicker, Marketing Manager of Dicker Data.

An integral 630-kb floppy disk provides compatibility with programs and data from any other floppy disk Vector microcomputer.

Both the 5032's hard and floppy disks utilise Vector's Dual Mode disk controller with automatic error detection and correction.

Full system back-up is available with an optional new Vector tape drive, a four-track 15Mb cartridge tape unit.

Other standard 5032 software in addition to extended CP/M includes Microsoft Basic, Scope editor and ZSM assembler.

Basic Vector 5032 MultiShare System hardware includes a video console and keyboard, MegaStor chassis with independent power supply.

8-inch Winchester hard disk drive and a floppy disk at a cost of $14,500.00. Each additional terminal is priced at $1995.00. The backup tape drive is priced at $3,695.00.

Moving House

John Guidice, owner of The Microcomputer House, has moved after 14 months in Regent Street, to much larger premises at 116–120 Abercrombie Street, Chippendale, Sydney.

This move has been made necessary due to the increase in sales of business systems and home computer systems. The new Microcomputer House has two showrooms so that business system sales can be separated from home computers.

With the increase in size, John will be expanding his range of products and his already extensive range of software. John is a dedicated 'micro' man who will write software packages for the individual businessman and has an extensive range of support peripherals.

Peninsula Store

Frankston now has a specialist computer showroom. It is owned and run by Brian Prince who has been in computing for 16 years in the U.K. and in Australia.

Most of his experience has been on mainframes until two and a half years ago when he bought his first micro, an Apple II. For the past 2 years, his business has been operating from an office at Tyabb on the Mornington Peninsula.

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SHARP PC1500

By Dick Pountain

It has been quite fascinating to watch at close quarters the battle for supremacy in the hand-held computer market over the last two years. Sharp got in the first blow with the PC1211, which was the first hand-held with Basic; Casio retaliated with the 702p which is faster and has more memory. Meanwhile, Hewlett-Packard strapped on quadruple memory and an interface loop to its established HP-41C calculator. Now Sharp has come back with a block-buster, the PC1500. Though it is clearly related to the 1211, it's an all-new machine which builds on the good features of the old but is very much more powerful. And it features a truly remarkable four-colour plotter/printer which has no rival at present.

Hardware

The PC1500 computer unit is enclosed in an alloy-faced ABS case of considerably larger size than the 1211 (195x 86x25.5mm), which reflects the use of four AA size batteries to power the expanded memory instead of the normal silver oxide or lithium 'button' cells. These give around 50 hours of use; a 6V mains unit is available for desk use. Opening up the case reveals a two-board computer with 14 ICs including the processor, a full 8-bit CMOS unit of Sharp's own manufacture, 16k of ROM and 3.5K of on-board RAM. A compartment on the back of the case next to the batteries has an edge connector for an expansion module. All of the RAM is, of course, non-volatile CMOS memory.

The keyboard is qwerty layout; similar to the 1211's but with rather larger keys which greatly improved its ease of use. The most noticeable difference is the row of six function keys under the display. Upper and lower case letters are obtainable either by the SHIFT or by a key called SML (for small) which toggles a caps-lock. The display is a 26-character LCD job with annunciators for operation and angular mode and BUSY to show a program is running.

Calculations performed to 10 figures (dynamic range of 10^{+99}) plus a two-digit exponet when in scientific notation. The speed of calculation is very greatly improved by the 8-bit processor, the 1500 ran my calculator Benchmark (see end of article) in 13 seconds, which beats the previous best Casio 702 (20 secs) quite comfortably. I also ran *APC* Benchmarks out of interest, to put things in perspective, even this is in an order of magnitude slower than a typical 2MHz, 6502-based machine.

The 1500 has, like the 1211, four modes of operation, but the ergonomics have been considerably improved. The MODE key toggles between RUN and PROgram mode. The DEF mode now has its own key and the top keyboard row has Basic reserved words permanently assigned; 18 of the other keys are available to have user programs assigned. The RESERVE mode now operates on the six function keys under the display and allows 18 commands (including carriage returns) to be assigned to them and used in RUN or PRO mode. This is achieved by a key ◊ which selects one of the three definition sets flagged as I, II and III in the display. Each command may be labelled with a string, and the RCL key displays the six labels over their respective keys. Reserve assignments are stored in 198 bytes of protected memory just below the Basic program area and can be saved to tape. The arrangement works very well, unlike that on the 1211 which was too fiddly to bother with. The editor is the same as the 1211's with full four-way movement through the program and insertion and deletion.

Basic

The interpreter on the 1500 is a full implementation of a Microsoft-style Basic and includes PC1211 Basic as a subset, together with 62 extra instructions. In particular, a full set of string functions is provided, including CHR$ and ASC, STR$ and VAL. Variable handling is orthodox, unlike that of the 1211 which configured the memory as an array. Names can be of any length, though only the first two characters are significant, and two-dimensional arrays are permitted. Strings are limited by default to 16 characters but may be

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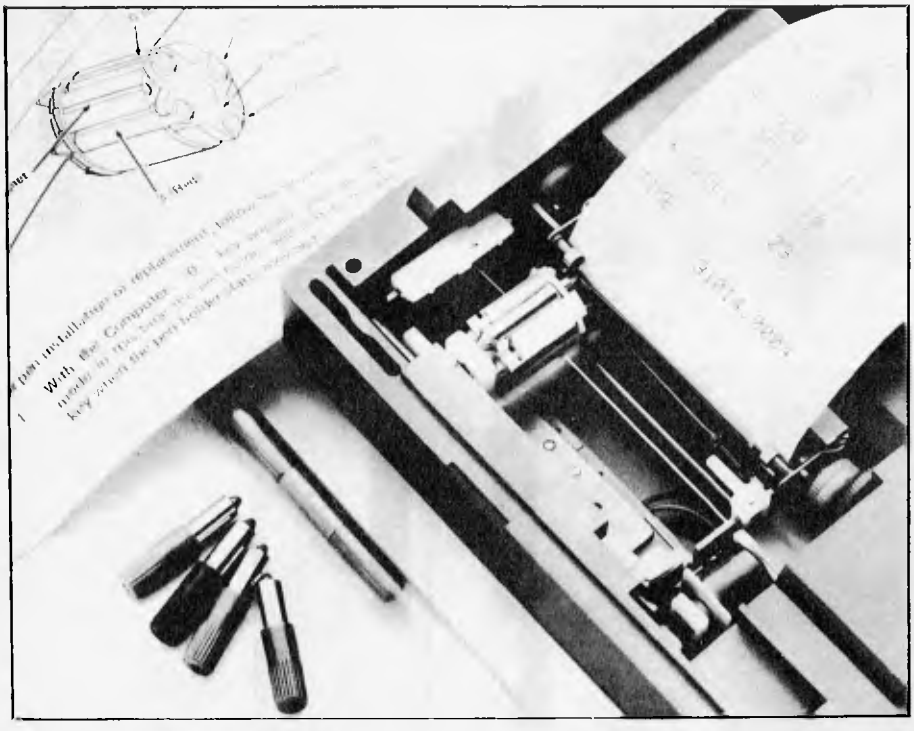
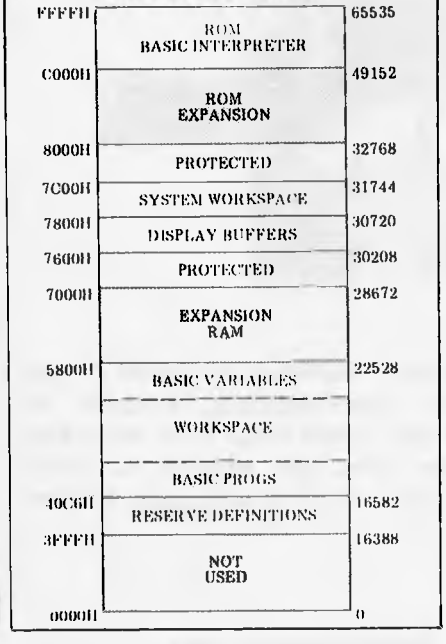
DIMensioned to up to 80. A nice touch is that variables with names A—Z are stored in a separate protected area which is not cleared by RUN, thus allowing values to be accumulated between runs. This area can also be used as an array called ∂ or ∂$.



MEMORY MAP



RND n generates a random number between 1 and its argument n and is repeatable unless initialised by RANDOM. In addition to PAUSE for output, there is a programmable WAIT [nnnnn] which holds a display for nnnnn units of 1/60th of a second. The PRINT USING has facilities to provide asterisk fill, commas, signs and the inclusion of characters in numeric formats. ON ERROR GOTO is provided for error trapping and TRON/TROFF for debugging. Another welcome 'big' Basic feature is the inclusion of READ... DATA... RESTORE [line number] to incorporate data into programs.

A real time clock-calendar is built in which displays in the rather unwieldy [monthdayhour.minutesecond] format when summoned by TIME. Together with the built-in beeper (programmable for pitch, volume and duration), this can be used as an alarm or to date-stamp printouts.

LOCK/UNLOCK is a clever feature which allows the programmer to lock the machine in its current operating mode; this stops a ham-fisted user accidentally corrupting programs or otherwise wreaking havoc.

Proper file handling is enabled by PRINT# and INPUT#, which allows multiple field records; CHAIN and MERGE can be used to segment and overlay programs from tape.

As if all this 'real computer' stuff was not enough, there is even a facility for dot graphics! The display is treated as a 7x156 dot matrix and the GCURSOR statement selects any column of 7 dots; the GPRINT statement then allows these dots to be set or unset by specifying a decimal or hex number whose binary representation is the required pattern. GCURSOR can take a string of arguments to define a whole shape in a single statement. POINT reads a column-value from the display.

No, your eyes are not deceiving you, I said *hex*. Not only does the 1500 allow hex (prefixed by an &) to be used in any expression but it has PEEK, POKE and CALL as well! You will look in vain for any reference to these in the manual (a Sharp spokesman tells me that a new manual, which covers machine code operation, will follow in time) but they work. With the help of PEEK I was able to uncover some of the labyrinthine twists of the 1500's memory map (also not in the manual) and to dump Basic programs and hence discover the system of tokens used for storage (two-byte codes beginning with 240 or 241 decimal are used for keywords and ASCII for the rest). A command called STATUS returns the number of bytes remaining (STATUS 0) and used (STATUS 1) as well as the address of the top of program and the bottom of variables (2 and 3). Basic begins at 16582, immediately above the reserve area, and variables are stored from 22528 down.

The basic interpreter/monitor sits between 49152 and the top at 65536. By CALLing into the right location in the latter area you can dump the contents in character-encoded form but until Sharp issues both the processor instruction set and a monitor listing nothing very useful can be done in this way.

To summarise, this Basic is far superior to that on any previous hand-held computer and even to that on some home computers. The only things I can find to bitch about (one has one's credibility to consider...) are the absence of DELete and RENumber and the unwieldy format of the DMS conversion routine which uses a single packed decimal number instead of having proper 01 11 separators. It would also be nice to see some built in statistics routines on a machine of this type, but that is perhaps stretching a ROM too far.

Printer & Cassette Interface

The CE-150 is one of those bits of machinery that must elicit a cry of admiration from anyone who has any respect for human ingenuity.

The plotter is a marvel of miniature engineering. A rotating drum like a gatling-gun contains four inch-long felt tip pens in black, red, green and blue; the required colour being swung into the firing position on request. Removing and loading the pens is quite easy for those with average motor control; it is recommended that they be removed and capped to avoid drying up when not in use.

The device is a true plotter in that it draws continuous lines, not dots; and the paper is moved in both directions. The set of plotting commands provided would shame machines at ten times its price.

Future Expansion

A 'Software Board' is due to be released at the time of writing which is an external pressure sensitive glass plate. It provides a matrix of 140 (14 x 10) flat user definable keys for easier date entry than the necessarily small keyboard proper. Six plastic overlays are provided for the 'Software Board' of which two already have application characters printed on them and four are blank and available for specific user applications.

In the pipe-line is an RS-232C interface to allow direct communication with devices such as acoustic couplers. Sharp expects this to be available in about six weeks.

GOTO page 101

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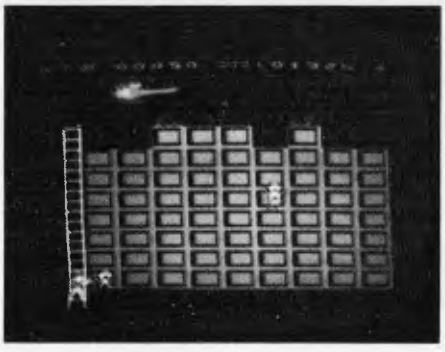
SCREENPLAY

This month Dick Olney & co review games for the Apple II.

This month I've been playing some of the games available for the Apple II microcomputer. Although this machine is rather different from most of those I've previously covered, and is not marketed as a games machine, there is a considerable volume of such software available for it. Apple itself produces very little in this area, but this is made up for by dozens of (mostly American) software publishers. The configuration I used was a 48k Apple II Europlus with a single mini disk drive and the Applesoft ROM with an automatic boot feature. The machine was fitted with a colour card and UHF modulator so that I could plug it directly into my television.

Apple will supply a set of games paddles for $35, but for most of the games I used a sort of universal joystick with dual buttons and paddle-emulating slide switches as well as the stick itself. This is manufactured in Texas by TG Products, and is undoubtedly the best-designed games controller I've used. The price of the system would be $2490 (incl. Sales Tax) for the machine and extras with an additional $60 for the joystick. This is clearly more than most people would be willing to pay just to play games, but I'm sure there are plenty of people with Apples who spend at least some of the time doing just that.

All of the games were of course supplied on 5¼in disks. Although I have concentrated here on real time arcade-type games I should point out that this machine is also notable for the many Adventure games available for it. Note that star ratings are based on a maximum of eight and reflect those qualities most appropriate to the nature of the game.



GAME: Firebird
PRICE: $39.95
SUPPLIER: Gebelli Software

Although this game has a very familiar feel about it I can't actually remember seeing anything quite like it. The scenario is a building, made up of 72 rectangular rooms, which is under attack from a firebird racing through the sky and dropping incendiary eggs at random. The latter set fire to a room, eventually destroying it and forcing its occupant to leap from the building. You can put the fire out (if you're quick enough) by positioning 'Piggo the fire-fighting pig' next to the room and dousing it with water; failing this you must attempt to catch the unfortunate occupant before he falls to his death. Moving Piggo and his ladder and squirting water are all controlled by the keyboard, and specific keys can be redefined to best suit your play.

If you manage to catch one of the falling victims you must take him to the top of the ladder where he will eventually be rescued by a circling helicopter. You should do this quickly since Piggo can only carry one person at a time, and cannot squirt water with his hands full. For each person saved the helicopter will replace one room; dropping it onto the top of the smallest column. The only hazard you encounter is if one of the people falls directly on top of Piggo, in which case he will topple off the ladder. He has three lives and the game ends when these have been used up or (more often the case) when two complete columns of rooms have been destroyed. If you manage to save the entire bottom row when all other rooms have burnt down you start a new frame.

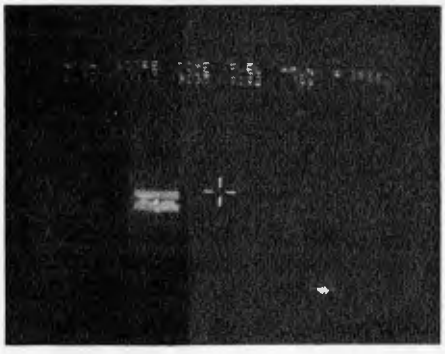
It takes some time to get used to this game, though it is well worth the effort. Firebird is well thought out and professionally presented, and should certainly provide plenty of entertainment. It is a little surprising that there is no joystick option, though the keyboard controls are satisfactory (they give incremental rather than continuous motion) so this shouldn't put you off.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *****
RESPONSE TIMES: ***
VALUE FOR MONEY: ******

GAME: Olympic Decathlon
PRICE: $29.95
SUPPLIER: Microsoft

This glossy athletics simulator from Microsoft is likely to receive a mixed welcome from gamesters. The manual insists that paddles or a joystick are necessary — these are in fact only used in two of the events; the shot put and the hurdles (neither of which were exactly my forte!). Mostly the game demands rapid finger movement over the keyboard, often literally using two fingers as legs as if running. Up to six players can take part, each entering their names into the computer, and there is the opportunity for unlimited practice before the decathlon proper. Each event is heralded by a little fanfare, and full instructions are displayed throughout with the option to look at the scoreboard at any time. The graphics and presentation are flawless, but the general pace of the game is rather slow because of the low percentage of the playing time during which you are active. The long and high jumps were my favourite events, closely followed by the pole vault. I must admit I found the frantic finger pumping in the track events rather boring and tending to cause severe knuckle cramp; but I suppose this mirrors reality in some ways! Essentially this is ten quite simple games neatly compiled into an exclusive games package (they are even accessed from disk individually). Although the actual 'events' are, in themselves, rather trivial and unlikely to stimulate the hyperactive Defender freak or intrepid Star Trekker, Olympic Decathlon should appeal to the family audience where it would undoubtedly provide many hours of amusement.

USE OF GRAPHICS: ******
ADDICTIVE QUALITY: ***
PRESENTATION: *****
VALUE FOR MONEY: *****



GAME: Epoch
PRICE: $37.50
SUPPLIER: Sirius Software

Written by Harry Miller (not THE H. Miller), this game is a true real time interpretation of Star Trek in which all movement and firing is controlled by the joystick or games paddles. Though it lacks the complexity found in more traditional games of this genre (there are no charts, scans or textual commands) the excellent use of graphics and control precision made it a joy to behold. You are under attack by four different types of enemy craft which can only be destroyed by a direct hit at the centre of their mass. To achieve this you position the crosshair sights over the alien ship before firing your missiles. These crosshairs dictate direction of motion as well as aim, and though of course they actually always remain in the centre of the screen, the impression of three-dimensional movement is surprisingly effective. One of the controller buttons gives acceleration and the other deceleration, and pressing them both together achieves self-repeating fire power. As well as alien ships there are stationary enemy bases which can again only be destroyed by accurate central hits.

The constraints upon your degree of destruction are fuel, ammunition and time — the game ends if any one of these runs out. The amount of fuel decreases steadily during any change of speed (though not while in stable motion) and also drops if you are hit by alien fire. Ammunition level, of course, depends on how many shots you fire. Both of these can be completely replenished by driving through the porthole of a friendly base, requiring careful navigation. Time is lost at a steady rate whatever you do and can only be regained by travelling through the centre of a time portal. These are great fun, involving steering the ship through a colourful corridor of gateways.

The fundamental principles of this game resemble the real time section of Atari's Star Raiders, though saying this does not do it justice. It is certainly one of the best games of this type that I've come across. If you've got an Apple II with a colour set up then you *need* Epoch.

USE OF GRAPHICS: *******
ADDICTIVE QUALITY: *****
RESPONSE TIMES: ******
VALUE FOR MONEY: *****

GAME: International Grand Prix
PRICE: $32.95
SUPPLIER: Riverbank Software

Given the front view from a racing car your task is this game is to use the paddle or joystick to drive as quickly as possible around a racetrack (no surprises there!). The interesting thing about this game is the number of options. Firstly there are five international circuits to choose from, each of which has all the elements of its real life counterpart. You can choose the number of laps, amount of fuel on board and difficulty level (zero to seven determines road surface skid potential) as well as manual or automatic transmission. The button on your paddle or joystick is used to accelerate the car. For manual transmission, taking your finger off the button for a second changes gear and with automatic you can stabilise your speed using the cruise control (space bar). The array of options and crisp presentation cannot however conceal the uninspired and rather dull nature of this game.

USE OF GRAPHICS: ****
ADDICTIVE QUALITY: **
RESPONSE TIMES: *****
VALUE FOR MONEY: ***

GAME: Fly Wars
PRICE: $21.79
SUPPLIER: Sirius Software

It's you (the spider) against the flies (unfair advantage to you), caterpillars which appear as each fly is eaten (a slight advantage to you — they drop bombs, of a substance I don't care to think about) and cocoons which appear as each caterpillar is destroyed (an easy target for any spider) and bug spray, which is a most unfair weapon to bring into what is otherwise a good, clean ecological game. The bug spray is instant death to the spider.

The game is best played with joysticks although the keyboard will do. It involves moving the spider around the screen to form a web which entraps as many flies as possible. Having captured its victims, the spider must then chase flies and caterpillars and eat them. As cocoons appear they must be pushed to the top of the screen where they explode and it is during this effort that the bug spray appears more frequently.

I'm not a great fan of this type of game, but personal preferences differ and if you're looking for something quite different from the normal shoot-them-before-they-shoot-you game then this would certainly be worthwhile.

USE OF GRAPHICS: ****
ADDICTIVE QUALITY: ***
RESPONSE TIMES: ****
VALUE FOR MONEY: ****

GAME: Jellyfish
PRICE: $21.79
SUPPLIER: Sirius Software

Another game which really requires joysticks, Jellyfish can be played by two people against each other or one against the computer. The object of the game is to guide a submarine over a nuclear waste canister (obviously left there by an inconsiderate twentieth century society) while avoiding collision with giant jellyfish, octopi and squid and taking pot shots at your opponent who should also be attempting to recover canisters.

It is interesting that your primary mission is supposed to be to recover canisters, which has a score value of 1,000 points, while 5,000 points are awarded to bumping off your opponent. The games I played quickly degraded into a hide and kill match among the giant jellyfish.

Jellyfish has good graphics and colour and is good value for money. It's really two games in one: if you're playing against an opponent, canisters are left rotting on the seabed while submarines fight it out.

USE OF GRAPHICS: *****
ADDICTIVE QUALITY: ****
RESPONSE TIMES: ***
VALUE FOR MONEY: ****

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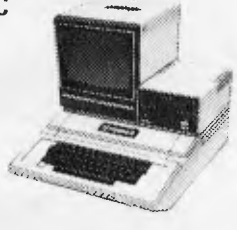

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SCREENPLAY

GAME: STAR BLAZER
PRICE: $35.78
SUPPLIER: BRODERBUND SOFTWARE

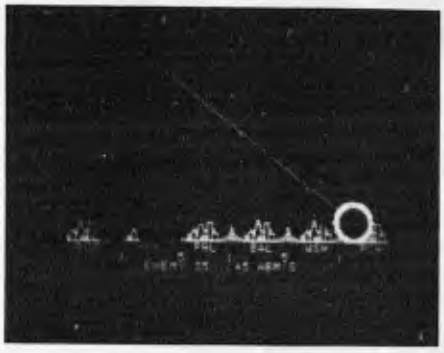
The name of this game is slightly inaccurate in that all play takes place within several hundred feet of the ground, moving up and down and from left to right in an attempt to bomb enemy installations.

The WWIII aircraft fires "pulse cannons" at oncoming missiles in levels beyond the initial scenario in which the aircraft has to destroy enemy radar installations in order to proceed to the next level. One possible criticism is a feeling of some lack of control because the firing button shoots either the "pulse cannons" or bombs, depending on the aircraft's altitude. This prevents the aircraft from conducting a bombing raid at high altitudes during lulls in enemy attack.

Five scenarios are provided with successively increasing levels of difficulty. The last mission is to wipe out the "Bungeling headquarters". This proved to be extremely difficult so the game certainly offers a challenge.

In summary: very good response time and excellent graphics, but should only be played with a joystick.

USE OF GRAPHICS: *****
ADDICTIVE QUALITY: ****
RESPONSE TIMES: ******
VALUE FOR MONEY: ****



GAME: ABM
PRICE: $29.95
SUPPLIER: Muse Software

As you may have guessed, this is a variant of the popular Missile Command, Atari's version of which I covered in April. It is in fact virtually identical except that you have five missile bases firing two different sizes of missile. Your task is, of course, to shoot down approaching nuclear warheads in an attempt to protect the east coast of the USA from its impending (and indeed inevitable) demise. Paddles or the joystick are used to guide the target sight and ABMs are sent ploughing towards its position at the press of a button. The precise action of the control unit can be customised at beginning of play, though apparently only once. In the original game the sight would leave a marker immediately you fired, whilst remaining active, allowing you to launch missiles as frequently as you wished. In ABM, however, the sight disappears while your missile is in flight and thus you can only launch them one at a time, a serious defect as it entirely changes the nature of play. The bombers and formidable 'smart missiles' seen in Missile Command are also sadly lacking in this game. I must admit that I like it anyway, so although I rate this 'cover version' a poor copy I should add that it's a good substitute.

USE OF GRAPHICS: ****
ADDICTIVE QUALITY: *****
RESPONSE TIMES: *****
VALUE FOR MONEY: ***** .

Conclusion.

As I mentioned in the introduction, the Apple II is neither designed nor marketed as a games machine. Despite this, the quality of the graphics and lack of memory limitations make it an admirable instrument for such pursuits. The games I have seen are varied and colourful and often of a quality much closer to that of their dedicated arcade peers than on smaller machines. Any Apple II users currently restricting their machine to more serious pursuits would be well advised to investigate its leisure potential.

Our thanks to Bob Shattock of ComputerLand South Melbourne (37 Albert Road, Ph: (03) 266 8647) for the loan of the Apple computer and joystick.

All software reviewed this month is distributed in Australia by Imagineering (Ph: (02) 358 3011) and is available from all Apple dealers.

ARCADE ACE

This month I have chosen a game whose variety has always impressed me, despite my inability to really master it. The oddly named Donkey Kong sets you the task of rescuing a maiden from an enraged gorilla. At the outset the gorilla carries his victim to the top of the screen and, using a four-way joystick, you control a little 'jumpman' who must ascend the various levels to save her. The problem is that our oversized primate is not too happy about your presence and spends his time rolling heavy barrels down at you. Luckily you have the ability to leap over these as they approach — but the timing of this is critical. There are a couple of mallets dotted around and if you manage to grab one of these you have a limited period of time in which you can smash the barrels before they reach you. To add further to your problems, as time passes increasing numbers of fireballs arrive to chase you.

The first frame is a simple configuration of girders and ladders with the main problems being the barrels and fireballs. If you manage to get to the top Kong makes off, carrying his reluctant victim to a new vantage point, and as the game progresses the scenarios become increasingly complex with lifts, conveyor belts and boiling vats to be negotiated. When you have successfully completed four screens the girl is finally released and the game starts again with increased ferocity. Donkey Kong combines simple controls with an interesting selection of game tasks. This, together with its colourful graphics, makes it almost as much fun to watch as to play and puts it at the forefront of the current move away from space shootouts.

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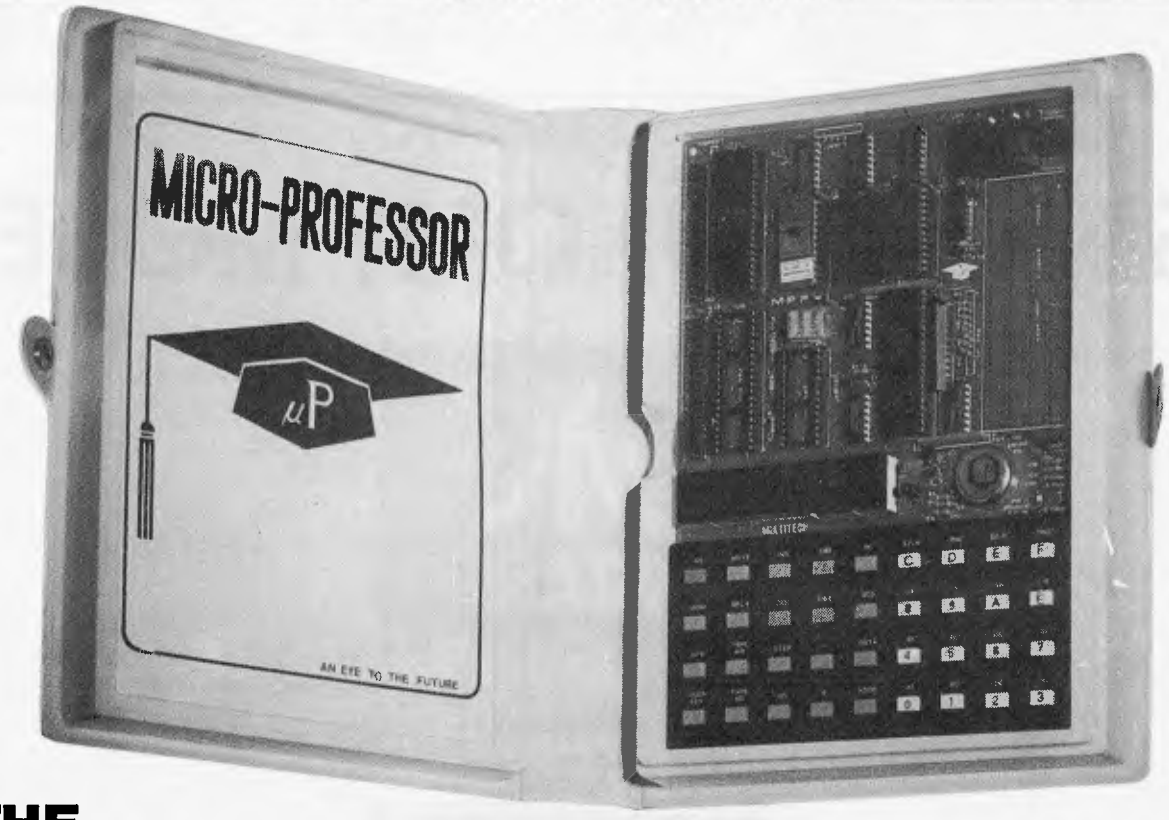

THE MICRO-PROFESSOR

by Steve Withers.

Introduction

Back in the days before Commodore launched the PET, the word 'micro-computer' conjured up an image of a circuit board with a couple of kilobytes of memory and a processor. Input and output consisted of seven-segment displays and a funny little keyboard that looked like a refugee from a calculator factory. Sometimes a cassette interface was included, sometimes you had to build your own. Such a micro would cost a few hundred dollars, and that didn't include a power supply.

Since then, microcomputers have become increasingly sophisticated. Generally speaking, manufacturers have offered 'more for your dollar', rather than 'the same for less'. Of course, there are exceptions, and after allowing for inflation, micros have become cheaper. This is to the consumer's benefit: I know people whose hobby computers include disk drives and high-quality printers, as well as colour graphics – 4 or 5 years ago, an acquaintance in similar financial circumstances had a system with 16k of RAM, a home-made video board driving a modified TV, and a Basic interpreter that took 5 minutes to load from cassette.

So the good old days (!) weren't that good, but people did learn a lot from those early machines, including the fact that programming in machine code can be very tedious. For all their advantages, I believe modern 'appliance' systems have two drawbacks. The first is that after spending a significant amount on a computer, one needs both skill and confidence to undertake the construction of hardware add-ons, if an interest develops in such projects. Secondly, the availability of increasingly sophisticated software can act as a disincentive to investigate machine code/assembly language, even if the idea is appealing.

These two points reinforce each other when the possibility of using a microcomputer for control purposes is raised. Consider a model railway enthusiast, who thinks it may be interesting to use a micro to automate some aspects of his or her system. Such a person is unlikely to spend much on a computer (trains are the main interest), and in any case most of the frills are unnecessary. The 'old fashioned' micro, with some extra I/O lines would be just the job.

The Micro-Professor

The Micro-Professor fills this gap very nicely, being both cheap and simple. The main ics are a Z80 processor, a 6116 2k RAM chip, a 4k EPROM (2532) containing the monitor program and a tiny Basic interpreter, and a 8255 parallel I/O chip. There's also a baby's handful of discrete components and 74 series TTL, but that's about it.

Input and output are correspondingly simple. A 36 key calculator style keyboard (with a surprisingly positive action) is software-scanned, allowing the key functions to be redefined. In fact, a cardboard overlay is provided for use with Basic, giving single-key entry of all keywords. Half a dozen seven-segment displays form the main output channel, backed up by a small speaker from which a variety of beeps and buzzes emerge. For example, each key depression is accompanied by a short bleep, but if this irritates you or your loved ones, it may be disabled by changing the contents of a single byte. A green LED glows in parallel with the speaker, while a red one indicates when the processor is HALTed.

The cassette interface has a data rate of 165 baud, but this may be increased or decreased to suit the recorder's performance. Unfortunately the parameters are stored in the EPROM, so programming facilities are needed to change them. An interesting feature is that when loading a file the software automatically adjusts to the speed at which it was recorded. Using a Sony recorder, saving and loading worked first time, every time, without any fiddling with the volume or tone controls. Incidentally, files are numbered, making it easier to store several on one cassette. Signals in both directions are monitored by the on-board speaker.

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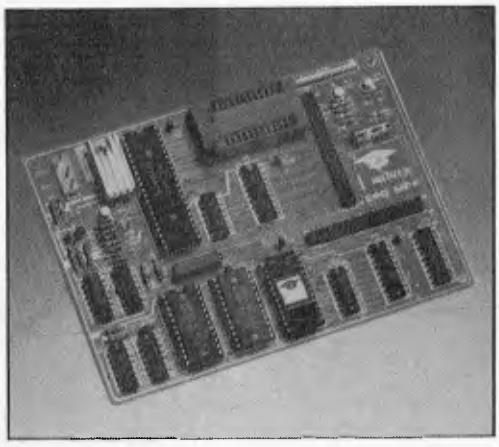
lowest level there are sockets for the Z80 PIO and CTC chips (all the relevant lines are brought out through a 40 way connector, as are the CPU lines), and for one additional memory IC. This may be a 2 or 4k EPROM, or another 6116 RAM (if a 2732 or 6116 is fitted, some cutting of traces and jumpering is necessary). There is also a small (33 x 85mm) wire-wrapping area for home-brewed circuits. A small range of add-on boards are available: a speech synthesiser, an EPROM programmer, a 20 column thermal printer, and a wire-wrap prototyping board. Any two boards will fit into the Micro-Professor's case, and they are connected by 40-way ribbon cables in a daisy-chain fashion.

The speech synthesiser and EPROM programmer boards were supplied for inspection, although I was unable to test the latter as it was fitted with a European style mains plug. It is said to be capable of programming any 5 volt, 1, 2, or 4k EPROM, and comes complete with on-board software, keyboard overlay, a Textool zero insertion force socket, and 4k of RAM which acts as a buffer during programming.

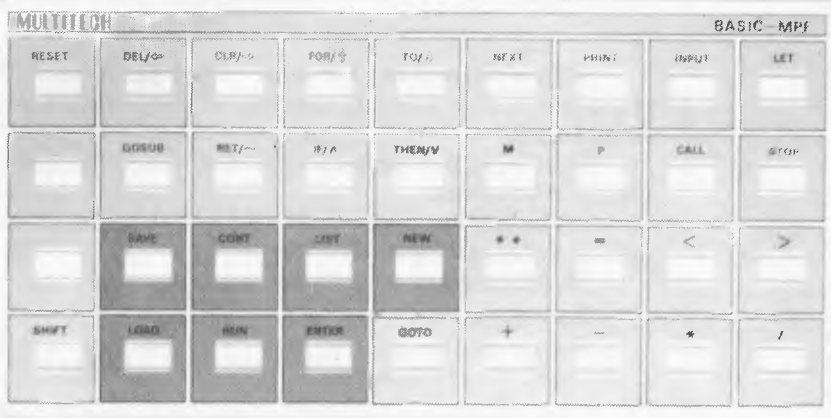
The speech synthesiser is based on the well-known Texas Instruments' chip and works quite well, although some utterances are less than clear (e.g. 'afternoon' comes out like 'afterloo'). The standard EPROM contains a 'talking clock' program and the appropriate vocabulary, as well as a couple of utility routines. Sockets are provided for two additional EPROMs as well as one TI Voice Synthesis Memory (a mask programmed 128k-bit RAM). Eight extra EPROMs are listed, unfortunately seven of them appear to be designed for use as a set) the first goes from 'A' to 'DOUBLE', the second from 'DONE' to 'HAS', and so on). Most of the words and phrases appear useful, but why would anyone want a machine to say 'Leon thinks it abnormal for a giraffe to roll on the ground'.

All the boards examined were well made, the only problem being dirty contacts on the speech synthesiser's power connector. My only real

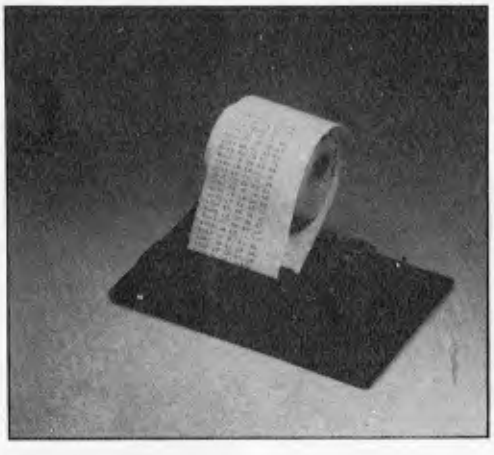


EPROM Programmer Board

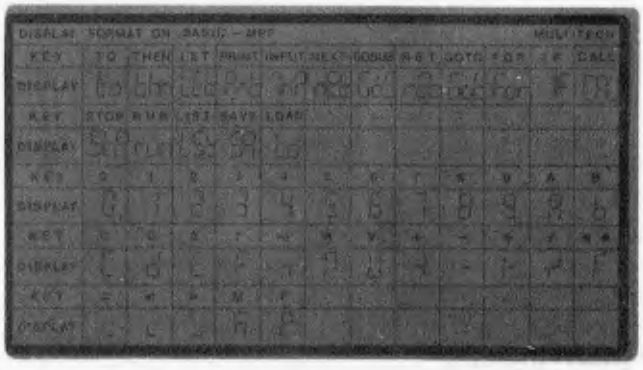
Speech Synthesiser Board



Pictured here are the Micro-Professor keyboard overlays. They fit neatly over the standard keyboard to alter the function of each key.



Thermal Printer



The chart above shows the sometimes difficult to interpret LED display characters.

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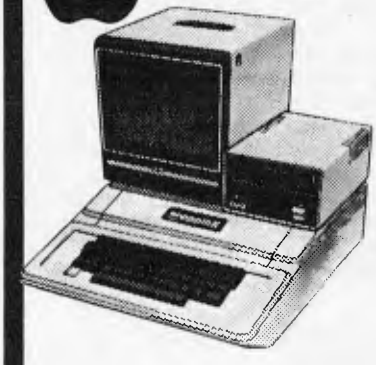

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criticisms concern the power supplies. An appropriate 'plug pack' adaptor comes with each board, but this means that an expanded system requires two or more mains sockets (the common 2-way adaptor cannot be used due to the size of the power packs). Although this reduces the cost of the basic system, it makes add-ons more expensive and is rather inconvenient. My main concern is that the voltage regulator's heat sink gets very hot, very quickly. The manual warns that a temperature of 70C is normal, and that the user should avoid touching the heat-sink, but I do not think that this is adequate in an 'open-plan' machine.

I was impressed by the documentation, which rivals that supplied with computers costing ten times as much. There are three large (258 x 189mm) manuals totalling 318 pages. The first is a user's manual which describes the use of the monitor program and its most useful subroutines, the hardware (full circuit diagrams are included), and programming summaries for the CPU, PIO, and CTC chips. A book of 18 'experiments' aims to give a grounding in the principles of assembly language programming. The first half covers the basics (arithmetic, branching, etc), while the remainder are projects like our old favourites, the digital clock and a music box. The third manual contains the complete annotated source listing of the monitor. The standard of English is very good compared with some south-east Asian products (the Micro-Professor is actually made in Taiwan), although there is the occasional quaint expression.

The monitor provides the usual facilities, allowing registers and memory locations to be examined or changed, breakpoints may be set or cleared, areas of memory saved or loaded, and programs may be run directly or single-stepped. Extra functions allow the interruption of a running program, block transfers and the addition or deletion of a byte, and the calculation of relative addresses. Since a key is dedicated to each function, the monitor could hardly be made easier to use.

'LEON THINKS IT ABNORMAL FOR A GIRAFFE TO ROLL ON THE GROUND'

In addition, the hex keys are also labelled with register names — to display the contents of the HL register, simply press 'REG' followed by 'HL'.

The tiny Basic interpreter only allows 16-bit integer variables (i.e. the range of −32767 to +32727), but all the important keywords are included (see Table 1).

Although PEEK, POKE, INP, and OUT are absent, their functions are provided by extensions to the LET statement. A number preceded with 'M' indicates a memory location, while port numbers are prefixed with the letter 'P'. Thus LET M1000=23 is equivalent to POKE 1000,23 and LET A=P255 replaces A=INP(255).

The seven-segment display is naturally a limitation. The keywords are recognisable (e.g. Got for GOTO and Prt for PRINT), but some of the operators are harder to remember (like |- for *). Right-to-left scrolling is used during program entry and listing.

While entering a line a limited amount of editing is possible — left and right arrows move the 'cursor' (actually the display scrolls from side to side) and then a character may be deleted or a new one inserted. When listing, pressing the left arrow redisplays the current line, while the up and down arrows list the adjacent lines. It may be far from ideal, but this system makes the most of the limited hardware. If you want a cheap computer in order to learn Basic, the ZX81 would be a better choice (but it does cost nearly twice as much). Think of the Micro-Professor's Basic as a bonus, and you won't be disappointed.

Conclusion

Overall, I was very impressed by the Micro-Professor, and the low prices of the basic unit and accessories make it very hard to criticise this product. I believe it will be attractive to several distinct groups. First of all, there are those who wish to learn about microprocessors (as opposed to microcomputers). Some purchasers will be individuals, the rest will almost certainly include educational establishments. It may also prove popular with people who already own computers, but do not want to risk their pride-and-joy when constructing and experimenting with hardware projects. Finally, the Micro-Professor could attract those looking for an inexpensive building block for control systems.

Prices (excluding Sales Tax)	
Micro-Professor	$115
Speech Synthesiser	$135
EPROM Programmer	$145
Printer	$ 95

Commands	Statements		Operators	
RUN	PRINT	RETURN	+	-
LIST	INPUT	IF...THEN	*	/
LOAD	LET	FOR...TO	**	=
SAVE	CALL	NEXT	<	>
CONTINUE	GOTO	STOP	NOT	AND
NEW	GOSUB		OR	

Table 1: The Micro-Professor Tiny Basic.

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POWER SUPPLY - A 9V, 0.6A Adaptor is optional
USER'S AND EXPERIMENT MANUAL - Complete self-learning text with experiments and applications.
BASIC-MPF - 2K tiny BASIC interpreter (BASIC-MPF) has been provided to Micro-Professor users for learning BASIC language programming. It is supplied on 2516 EPROM and can be plugged directly into the expansion memory socket of Micro-Professor. The commands and statements of BASIC-MPF include: CONTINUE, CALL, FOR . . . NEXT, GOTO, GOSUB, INPUT, IF . . . THEN, LET, LIST, LOAD, NEW, PRINT, RETURN, RUN, SAVE, STOP

KEYBOARD: 36 keys including 19 function keys, 16 hex-digit keys and 1 user defined key.
RS- Reset the system.
ADDR- Set memory address and display memory content.
DATA- Input data to memory or register.
PC- Recall program counter.
REG- Select register and display contents of register.
+- Display content of next memory address or register.
—- Display content of last memory address or register.
STEP- Single step execution of user's program.
SBR- Set break point of user's program.
CBR- Clear break point of user's program.
MONI- User's program break and return to monitor.
GO- Execute the user's program.
INS- Insert data of the address followed by the current display address.
DEL- Delete data of the current display address.
MOVE- Move memory block in the RAM.
RELA- Relative address calculation, calculates and stores relative address.
TAPE WR- Store data to the cassette tape.
TAPE RD- Load data from the recorder.
INTR- Maskable interrupt.
USER KEY- User defined key.
0-F- Hex-digits or register selection.

OPTIONS:

EPB-MPF

EPROM programmer board (EPB-MPF) is a low-cost and powerful tool which provides the programming tool for the EPROM types TI TMS2508, TMS2516, TMS2532, INTEL 12758, 2716, 2732.

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PRINTER

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APC-80 Version 7

APC-80 continues this month with a selection of Basic PEEKs and POKEs for TRS-80s and System 80s.

It is the policy of APC-80 not to provide assembly language routines for any functions which can be implemented adequately under Basic. APC-80 routines are created purely for actions which are either not possible in Basic, or would run too slowly. For example, we often receive requests for a PAUSE routine, but decline to put it in APC-80 since the same effect can be achieved using a dummy FOR loop. This months APC-80 provides a number of handy PEEKs and POKEs which can be put to use in Basic programs.

RE-DIRECTING SCREEN OUTPUT

It is quite common in programs that produce data as output to provide the option of directing output to either the printer or the screen. The usual way of doing this is to set a flag depending on the desired output destination, and then prefix every PRINT statement with

```
IF flag THEN PRINT ....
       ELSE LPRINT ....
```

This is not only tedious but also wasteful of memory. A much more satisfactory solution is to be able to declare that all screen output should be redirected to the printer. This can be achieved simply by knowing the addresses of the vectors that point to the device drivers. The double byte at 16414 points to the screen driver and 16422 points to the printer driver.

Knowing these addresses, it is a simple matter to issue a couple of statements to direct screen output to the printer. These statements are

```
POKE 16414, PEEK (16422)
POKE 16415, PEEK (16423)
```

In order to reset the condition so that screen output takes place normally, it is necessary to know the original setting of the screen vector. This value may change depending on what Basic you are running. Therefore, one of the first lines of your program should be

```
LET SV = PEEK (16414) + PEEK
   (16415) * 256
```

It is now a simple matter to reset screen output by executing the statements

```
POKE 16415, SV /256
POKE 16414, SV – PEEK (16415) x
   256
```

It is essential that the LET statement used to set the variable SV be executed before any output redirection is performed, otherwise it will not be possible to resume normal output operation.

PRINTER STATUS

In any programs that make use of a printer, it is often a good idea to be able to check if the printer is actually connected and if it is ready to receive data. Adding these types of tests to your programs makes them more robust to external conditions.

Printer status can easily be tested by PEEKing memory location 14312. The various values which can be returned from this location will depend on the printer that you are using, so a certain amount of experimentation is required to find out which status codes your printer supports.

DYNAMIC MEMORY SIZE

As many of you will already be aware, it is a simple matter to alter the memory size of your machine without reverting to a power-up state. This can be done while a program is residing in memory and even while the program is executing.

The current memory size is stored in the double byte at address 16561. To alter the memory size to the value in variable MS, simply execute the following statements

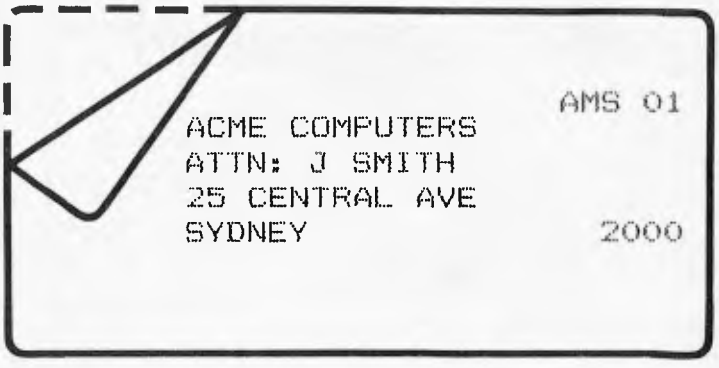
```
POKE 16561, MS/256
POKE 16562, MS–PEEK (16561)*256
CLEAR
```

Note that MS does not have to be a variable, you can substitute any value you like. The CLEAR statement is necessary to repair the Basic variable area.

NEXT MONTH

APC-80 will continue next month with a stand-alone source maintenance utility.

MOVING



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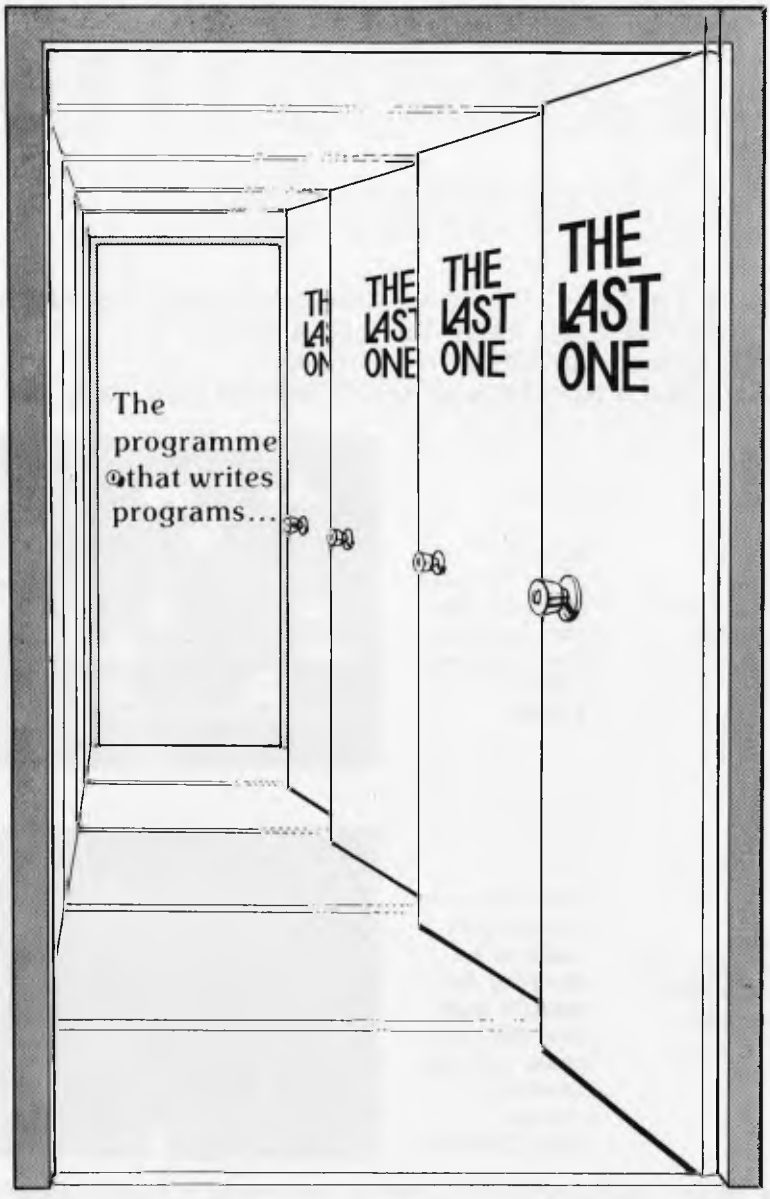

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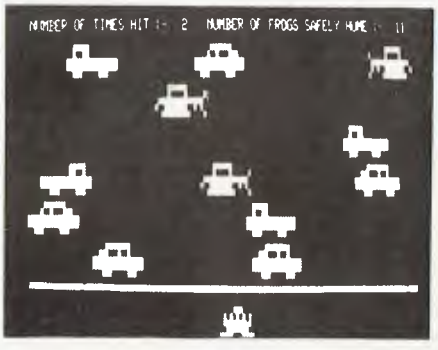

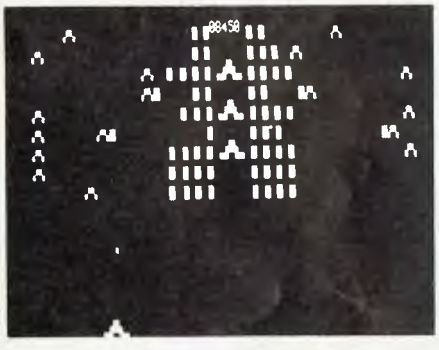

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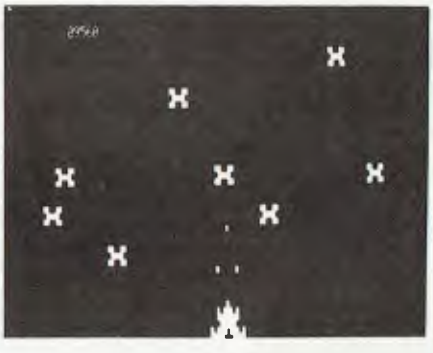

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COMMUNICATIONS

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IncomPETable

Why will cassette programs written for the 80-column PET not run on my VIC-20?

W P Scott,

There are two possible causes. Firstly, if the program contains machine-dependent items such as PEEK or POKE addresses or machine code, then these will probably need some alteration in order to work as intended. Secondly, if the program is Basic throughout, when it loads into the VIC it is re-located. In so doing the pointers that link one Basic line to the next will need to be corrected. You can force the VIC to do this by entering a dummy line at the beginning, such as 0 REM then deleting it.

R D Geere

Arming the VIC

Is there any way in which I could get my VIC-20 to operate a robotic arm of some sort without having to spend a lot of money?

Philip Richardson,

It depends what you call a lot of money! Presumably the arm movements are to be controlled by electric motors, either conventional or stepper motor type, and to drive these you will need an interface connected to the user port. Design of this interface will depend to a large extent on the details of the motors. Alternatively, an increasing number of companies are advertising robot arms ready built and tested, some of which will connect direct to the VIC-20.

R D Geere

Quick cursor

I need a fast routine for positioning the cursor anywhere on the screen of my 8000 series PET. The two standard methods of using loops with cursor movements and POKEs with calculations are too slow. Can you help?

David James,

The following hex code can be placed into locations 0384 to 03AB and be called via Basic using SYS 900,X,Y, where X and Y are the column and row for the cursor.

```
0384  20  F5  BE  20  98  BD  20  2D
038C  C9  A5  11  29  1F  85  D9  20
0394  F5  BE  20  98  BD  20  2D  C9
039C  A5  11  29  7F  85  C6  78  A5
03A4  D9  85  D8  20  67  E0  58  60
```

I hope this solves your problem — it is quite fast. — Ed.

Compatible compiler?

I am developing a package on a microcomputer system running under CP/M and MBasic. I have two requirements that I cannot solve and wonder whether the Microsoft Basic compiler would help; is it compatible with MBasic? The problems are that first I cannot disable the 'Control-C' break into Basic; and second, I cannot provide enough protection from people looking at the program listing.

D Johnson,

I have not found how to trap the 'Control-C' break-in to Basic, when running under MBasic. However this *is* disabled when the program has been compiled. One way to provide some means of protection against prying eyes is to use the 'P' option when saving the program; (ie SAVE "PROG 1", P). The real way to do it is to use the compiler, though. This leaves no copy of the source once you have compiled and erased it.

The Microsoft Basic Compiler is as compatible as is reasonable with MBasic. As long as you haven't used dynamic arrays or the ERASE statement, then you are unlikely to encounter any problems. A few points are worth considering if you are writing with a compiler in mind:

1. Use integer variables as much as possible as they will speed up the running, and keep the size of the object code to a minimum. This is hardly true when using an interpreter.
2. You can liberally scatter REMark lines around as these are ignored by the compiler. Indent loops as well as this makes the code easier to read.
3. Use long (descriptive) variable names, as again the compiler codes these.

The compiler will also check all your syntax for you, and find unassigned statements. I had an interpreted Basic program running without errors for two years; when I compiled it I found two unassigned GOTOs. Finally, the Microsoft Basic compiler produces object code which is disappointingly slow — it is only about twice as fast; so don't expect startling improvements, especially as most time might be spent on file access anyway.

While on the subject of compilers, I get many enquiries asking about the speed improvement of compilers. I think this is often over-emphasised. If your program spends much of its time accessing files or printing, then a compiler will not make any noticeable improvement, especially if it runs using CP/M which will slow it down anyway.

Fearsome factors

In response to your 'Factors Freak' in the May 1982 'Communications' columns, I suspect that the answer is, 'not in a million years'. The reason for this (and I quote): 'Multiplying is easy for a computer, but factoring is extremely difficult. For example, whereas two 100-bit factors can be multiplied electronically in a fraction of a second, the reverse process of factoring them might take a million years, even with a one-microsecond instruction time.' ('Electronic Cryptography' — *Wireless World*, 9/80.)

The article I quote from is a discussion on methods of Data Encryption, where the security of the system relies on the above-mentioned facts; ie, knowledge of the factors involved permits the decipherment of text enciphered by the result of such a multiplication. The cipher 'keys' are easy to create and use, but without the factors being known the 'code' is well-nigh impossible to break — I wonder if that's why D Hunter wants his 150-digit number factorised?

The commonest methods of factorisation are Exhaustive Search, whereby the factors of a number N are found by testing each integer from 1 to N in turn and noting down those which produce no remainder when divided into N (which is the rigorous mathematical definition of a Factor), and an optimised version of the Exhaustive Search which I tend to call Exhaustive Reduction. This works in a similar manner, except that only prime numbers are tested and as each factor of N is found, it is divided into N and the quotient factorised instead.

This method produces the Prime Factors of N, from which all factors on N may be produced by cross-multiplication. For numbers with a lot of factors this method works exceptionally well, and since it is a recursive process (of sorts), it proves rather easy to program onto a computer. The difficulties arise if the number is exceptionally large, and has relatively few factors.

If the 150-digit number you published is 'rich' in (low) prime factors, and a table of prime numbers is available, or can be produced easily by your computer (mine reeled off the first 1000 or so in about 15 minutes) then the task of factorisation merely requires a standard computing 'trick' to con the computer into doing 150-digit arithmetic for you. (Divisions are, unfortunately, the hardest to program!) Itwill also require a mass of machine time, though the judicious use of multiple processors should speed this considerably.

If, as I suspect, this number only has a very few

COMMUNICATIONS

large factors and a handful of smaller ones, then even using a Cray 1 mainframe dedicated to the task might take a lifetime (or several).

A W Bain

VIC voice

I read with interest your reply in May APC to Mr P Richardson who enquired whether or not it was possible "to get his VIC to speak". Your answer was a bald " . . . forget it".

Your answer is incorrect. – At Edible Electronics we have developed a program which produces speech via the CB2 pin on any Commodore Computer. Hardware requirements are simply a normal Commodore cassette drive and a user port socket; 32k of RAM stores up to thirty seconds of speech. Interested readers should contact us at Edible Electronics.

Hoping this is of interest.

Joel Gotlib

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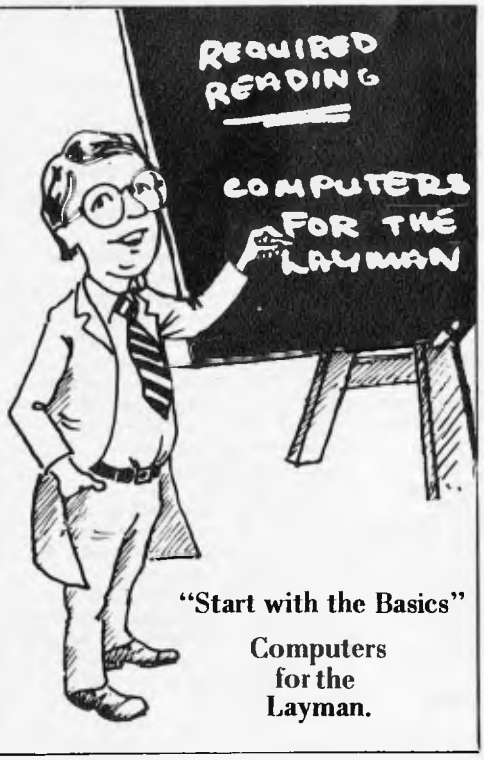

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BITS

Alan Sutcliffe continues his thought-provoking series.

A popular exercise in computer graphics is to take a design already represented in store and displayed on the screen, and to make a reverse copy of it alongside, making a pair of mirror images.

I set out to write a short note on how to do this, illustrating it with the particular code for my computer, but along the route I was waylaid by an intriguing series of numbers which themselves give rise to some interesting patterns. It turns out that the central bit of processing necessary to reverse an image on a micro involves reversing the order of bits in a byte. This is because the screen map for graphics cannot afford the luxury of eight or even 16 bits for each cell on the screen that is possible on larger systems. Bits have to be packed into one or two bytes representing several cells on the screen. More of that later.

First I give four ways of reversing the bits in a byte, a kind of theme and variations in programming; then some patterns based on the values of reversed bytes, and lastly the problem that started all this, reversing an image on the screen.

Reversing bits

The process of taking a byte and reversing the bits in it is a single valued function of one argument. Like SIN(X) and LOG(Z), it takes one value and returns one value.

The first thing to decide in programming a function like this is whether the value is to be computed each time one is called for, or whether it is possible to compute the values once for each value that the argument can take and then store the results in a table. This is not practicable for functions like SIN and LOG, as there are far too many possible values. However, for our function there are only the 256 possible values of a single byte 0 to 255. The advantage of using a table is increased speed when the function is used, since the only cost is a single reference to an array. The price is the computation of all the values at the start of the program and the store needed for the array of 256 elements. This is the method used for the following.

Now we come to the far less important but much more interesting question, from the point of view of computing efficiency, of just how the reversed values are to be calculated. You might think of doing it by hand and storing the 256 values explicitly in DATA statements. Here is part of the table to show how the values go, in both binary and decimal:

00000000	0	0	00000000
00000001	1	128	10000000
00000010	2	64	01000000
00000011	3	192	11000000
00000100	4	32	00100000
00000101	5	160	10100000
— — — —	— —	— —	— — — —
11111110	254	127	01111111
11111111	255	255	11111111

But that way is cowardly cheating — I have a computer to perform precisely this kind of task. So here is the brute force computer method. Each bit is extracted from the byte by ANDing it logically with the appropriate power of 2 and then shifting it right or left the correct number of places, which is easily done by division or multiplication. For example, (I IAND 2)*32 picks out the second lowest bit and moves it up to the second highest position in the byte. Program A shows the whole code. The calculation is split into two lines simply to avoid having too long a line. On my computer, all eight expressions in one statement produced the error message LINE TOO COMPLEX, so you might have a similar problem on your machine.

Second method

Now this program is correct and the fact that it is a bit slow hardly matters since it only takes a few seconds anyway, and it is only five lines. But I have this mean temperament that drives me to look for ways of saving a second here and there, no matter what the cost, plus a slight obsession with programming elegance.

The first method I thought of was a mixture of the two I have described so far, the manual and the brute force. It uses a table of the 16 reverse values for the 4-bit nibble or half-byte calculated by hand to set up the main table in a double FOR loop. This is Program B. You can easily confirm that the values in the DATA statements are correct by completing the following table for 4-bit reversals.

0000	0	0	0000
0001	1	8	1000
0010	2	4	0100
— — —	—	—	— — —
1111	15	15	1111

Statement 70 uses this table stored in array B to take the top nibble, reverse it and put it at the bottom and contrarywise with the other half of the byte.

Although this takes more than twice as many statements it is very little longer in number of characters to be stored, and very much faster to run. A quick and rough way to compare two pieces of code like these for speed is to count the number of elementary operations in the inner loops. In each case this loop is obeyed 256 times. In program A there are, for example, four multiplications while in program B there are only two. A simple table shows the comparison, where () is the number of references to an array element, an operation that may cost an addition and a multiplication.

	+	*	/	()	=	IAND	Total
A	7	4	4	1	2	8	26
B	2	2	0	3	1	0	8

The total may be misleading if the differences are for very different kinds of operation: IAND is very much quicker than an array reference. Since Basic is interpreted, the cost of this can be approximately compared by counting the number of characters, or more correctly the number of tokens, a variable name and a reserved word, each being a single token. Using these two measures Program B runs three or four times faster than program A. The overheads in program B for setting up the array B and for having two loops make hardly any difference. They have one sixteenth the effect they would have inside the inner loop.

Algorithmic method

The table below shows the reversal values for each number of bits up to four.

0	0										
1	0	1									
2	0	2	1	3							
3	0	4	2	6	1	5	3	7			
4	0	8	4	12	2	10	6	14	1	9	...

From this, a clear pattern of how the series for n bits can be obtained from that for n-1 bits may be seen. The first half of the series is doubled, and the second half is the first with 1 added to each item. If T_r is an item in the list for n bits, and S_r is an item for n-1 bits, the rule is:

$$T_r = 2*S_r \quad \text{for } r=0 \text{ to } N-1$$

and

$$T_r = 2*S_{r-N} + 1 = T_{r-N} + 1 \quad \text{for } r=N \text{ to } 2*N-1$$

where $N = 2^{n-1}$.

Program C implements this algorithm recursively, so that the table for each number of bits up to eight is computed in turn. Notice that the rule even works going from zero bits to one bit, so that the only data that needs to be supplied is to set the first element of A to zero.

The attraction of this method is its elegance and its generality. Given an array big enough, Program C will compute the table for any number of bits: one more than the number given as the upper limit in the FOR loop, statement 40.

From the point of view of speed, however, there is a penalty. The inner loop is not executed 256 times as in the other programs, but 1+2+4+8+...+256 = 511 times — virtually twice the cost. It contains ten elementary operations to eight in Program B, but there are no multiplications so each time round the loop is probable faster.

Three very different looking programs. Interesting that they all produce the same result. Here is just one more — that uses another pattern in the construction of the series.

The first value is set to zero. Then the series for one bit is generated, but

this time in the positions it will occupy in the final table for eight bits: 0 is already in place, and the 1 goes in cell 128. Next the values that will make the series for two bits are added: 2 in cell 64 and 3 in cell 192. And so on.

Program D does all this. It is not obvious, perhaps, just looking at it how it works, but it is easy to obey the first few steps with pencil and paper — and its operation then becomes clear. It is more efficient than any of the others. The inner loop is obeyed 256 times and it contains five operations, with no multiplications.

It also makes a good test of program comprehension. Ask a friend who hasn't read the story so far to work out without a computer what this little program does and why. I would be very impressed by anyone who could figure this out without benefit of writing anything down.

But enough of numbers for a while and on to some graphics — graphics based on these numbers, that is. Program E is simply a histogram of the table for six bit reversals, made pretty with a little flower at the top of each stalk. Array A is already loaded with the values. Figure 1 shows the result, and maybe you can tell that I am doing this just before Christmas.

One or two small points about this program. I used the 6-bit table with 64 values rather than 128 or 256 values simply to get a more bold effect. The first and last values in the table, A(0) and A(63), are left out because the petals of the flowers, if that's what they are, would go off the screen for these two extreme values. It also makes for a more compact picture. It is necessary to plot the lines in descending value of I because otherwise the longer lines plotted later would obliterate petals on the shorter stems next to them. A pretty pattern, simple certainly, but effective I hope.

Program F uses the eight bit values to plot overlapping rectangles. Figure 2 shows the output, reminiscent of a design from the 1920s. The first FILL statement draws a rectangle and the second one draws another one row of cells smaller along each side, so the effect is of a rectangle with a border. That is unless the random function which is used to determine the colour in each case gives the same colour for both rectangles in a pair, when the border is invisible. Different effects can be obtained by using different values for the STEP in statement 520.

For both graphics I changed the colours to one more suitable for photographing once the design was on the screen. This is done by a single COLORG statement.

Taking photos

A few words about my experiences in taking photographs from the screen. I am now using a monitor with RGB input, so that the pictures on the screen are crisp and clear. I have found it pays to take great care in positioning the monitor and camera. For the pictures shown here I used a Polaroid SX-70.

My tips are these. Make sure both the screen and camera lens are as near vertical as possible. Get the camera in line with the centre of the screen. Obvious stuff, but it is worth taking measurements to ensure this. Otherwise there will not only be more depth of field than need be and so more problems of uniform focus, but also verticals and horizontals at the edges of the screen will be curved. At little over a foot away from the screen there is still a problem with more light in the centre than at the edges, particularly obvious in Figure 2.

Reversing a picture

Now to use the byte reversing array A to give the mirror image of a graphic on the screen. It is necessary to say something about the screen map which is shown in Figure 3. My example is for four colour mode in low resolution,

GOTO page 78

```
10  DIM A(255)
20  FOR I=0 TO 255
30  B=(I IAND 10*128+(I IAND 2)*32+(I IAND 4)*8+(I IAND 8)*2
40  A(I)=B+(I IAND 16)/2+(I IAND 32)/8+(I IAND 64)/32(I IAND 128)/128
50  NEXT I
```

N.B. IAND is the instruction for a bitwise AND in this Basic.

```
10  DIM A(255),B(15)
20  FOR I=0 TO 15
30  READ B(I)
40  NEXT I
50  FOR I=0 TO 15
60  FOR J=0 TO 15
70  A(16*I+J)=B(I)+16*B(J)
80  NEXT J
90  NEXT I
100 DATA 0,8,4,12,2,10,6,14
110 DATA 1,9,5,13,3,11,7,15
```

Program B

```
10  DIM A(255)
20  A(0)=0
30  N=1
40  FOR I=0 TO 7
50  FOR J=0 TO N-1
60  B=A(J)
70  A(J)=B+B
80  A(J+N)=B+B+1
90  NEXT J
100 N=N+N
110 NEXT I
```

Program C

```
10  DIM A(255)
20  A(0)=0
30  M=1
40  N=128
50  FOR I=0 TO 7
60  FOR J=0 TO 255 STEP N+N
70  A(J+N)=A(J)+M
80  NEXT J
90  M=M+M
100 N=N/2
110 NEXT I
```

Program D

```
200 MODE 2
210 COLORG 0 1 2 3
220 FOR I=62 TO 1 STEP -1
230 B=A(I)
240 DRAW B,0 B,I 1
250 DOT B,I 2
260 DOT B-1,I 3
270 DOT B+1,I 3
280 DOT B,I-1 3
290 DOT B,I+1 3
300 NEXT I
```

Program E

```
500 MODE 6
510 COLORG 0 1 2 3
520 FOR I=0 TO 127 STEP 3
530 B=A(I)
540 C=A(255-I)
550 FILL I,B 255-I,C RND(4)
560 FILL I+1,B+1 254-I,C-1 RND(4)
570 NEXT I
```

Program F

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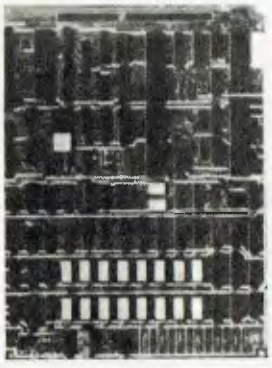

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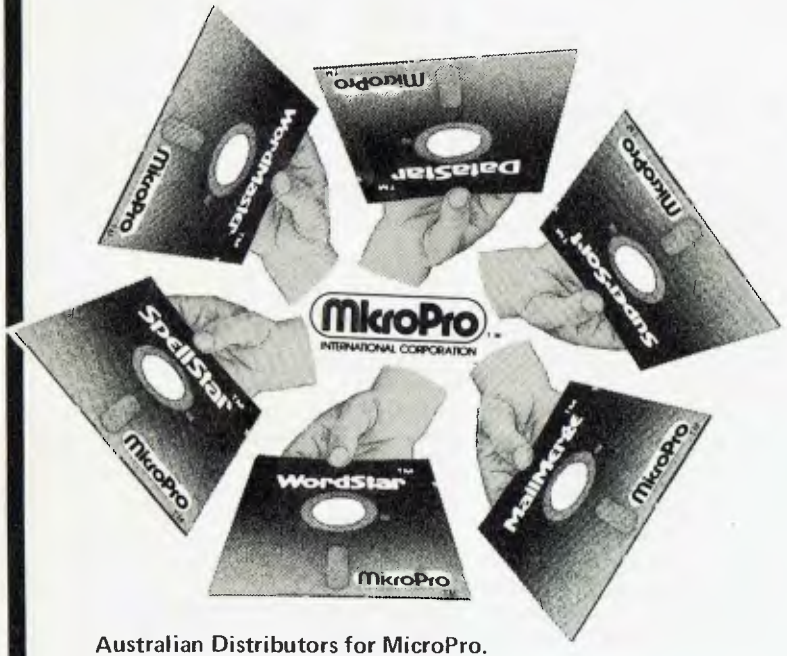

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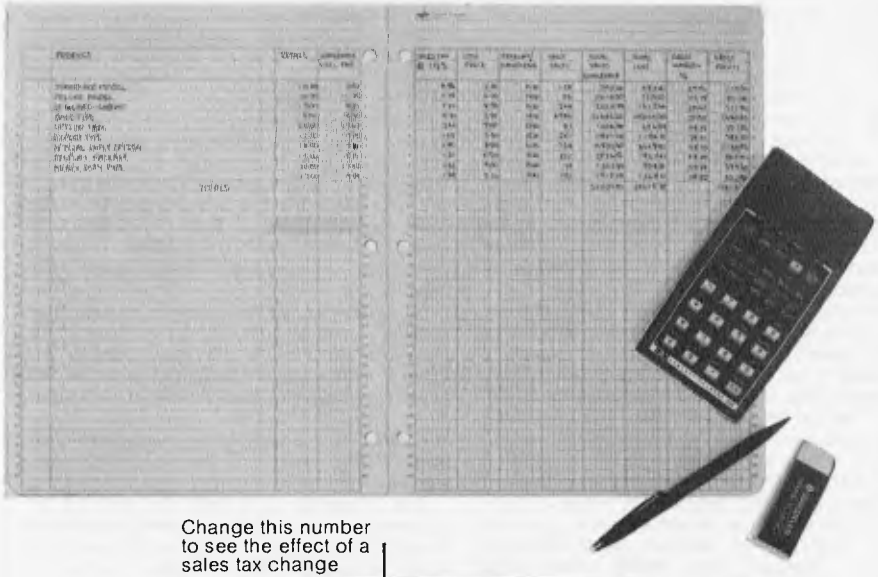
15 seconds to answer.

You're probably solving this sort of problem by pulling out an analysis pad and drawing up a spreadsheet by hand – taking your budget and recalculating every value in a series of columns – then checking them. If you're lucky you have a programmable calculator to help.

Here's what you should be doing: Multiplan running on a personal computer replaces pencils, paper, erasers, calculators and endless manhours in modelling, estimating and planning activities. Like the example here: if your sales tax rate is 17.5%, you simply put that figure at the top of the sales tax column – Multiplan calculates each product's sales tax value. If a price changes or the tax rate changes, you change one number –Multiplan changes the rest. You see all the results on a spreadsheet 63 columns wide, 255 rows deep and pages thick.

Multiplan is a computer program for non-computer people. Multiplan lets you assign names to cells or areas such as 'sales' or 'expenses', then lets you refer to that name in future formulas. On Multiplan you can have a formula like:
Profit = Sales – Expenses
On other spreadsheet programs that would look more like:
Profit = R1C3 – R5C12
Multiplan is also the only spreadsheet program capable of colour operation and there are none of the problems with forward reference handling that can cause other programs to give completely spurious answers. Multiplan lets you access data on other spreadsheets and allows multiple windows on the screen so you can see the effects of new entries on other parts of the sheet.



Change this number to see the effect of a sales tax change

Column widths are individually variable

All dependent variables are automatically calculated to your formula

PRODUCT	RRP	W SALE (INC TX 17.5%)	S.TAX	COST PRC	FRT	UNIT SALES	TOTAL SALES	TOTAL COST	GROSS MRGN %	GROSS PROFT
STD MODEL	10.00	5.00	.86	3.00	.25	1.20	703.20	493.20	29.86	210.00
DELUX MOD	20.00	11.75	1.75	6.00	.50	.86	1010.50	709.50	29.78	301.00
STD-CHROME	15.00	8.81	1.31	4.50	.30	2.64	2325.84	1613.04	30.65	712.80
BASE TYPE	8.00	4.70	.70	2.80	.18	69.46	32646.20	25805.60	30.55	7640.60
OPTION PK	30.00	17.62	2.62	9.00	.60	.57	1004.34	696.54	44.19	307.80
EXPORT TYPE	12.00	7.05	1.05	3.00	.20	2.81	1981.05	1194.25	39.71	786.80
SPEC INPUT	16.00	9.40	1.40	4.80	.25	7.24	6805.60	4669.80	45.73	2175.80
DISPLAY PKG	15.00	8.81	1.31	4.50	.30	3.22	2836.82	1967.42	44.19	869.40
HEAVY DUTY	30.00	17.62	2.62	9.00	.60	.74	1303.88	904.28	44.19	399.60
SPEC DISPL	17.00	9.99	1.49	5.20	.42	1.92	1918.08	1365.12	28.82	552.96
TOTALS							52435.51	38618.75		13816.76

Simulated screen

Multiplan is expected in stock and the price is correct at time of going to press.

Multiplan Apple II version: $295 + tax

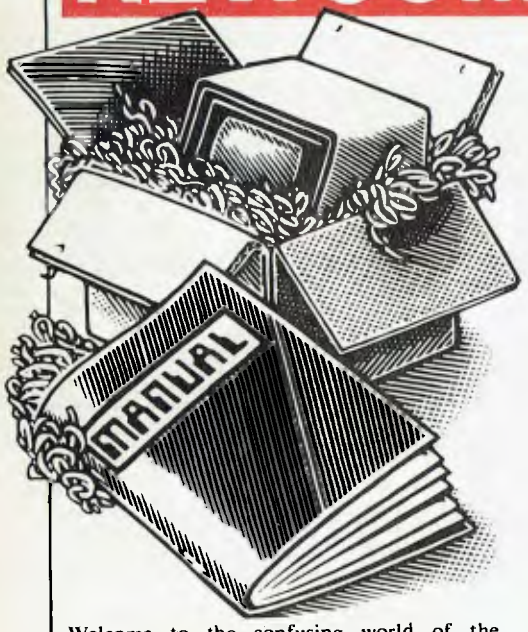
from **MICROSOFT**

For the name of your nearest Microsoft dealer or more information on Multiplan contact:

Wiser-Microsoft
PO Box 95, Forestville 2087. Ph (02) 451 9445

Glover & Assoc. WM/6

NEWCOMERS START HERE



This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in APC. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, APC will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 .... E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — Telecom isn't so uppity about the use of these.

FMS SOFTWARE AND HARDWARE FOR CP/M BASED SYSTEMS

Agent for: Lifeboat Associates, Sigma International, Compuview, Westico, Memtech, Anderson Digital Equipment, AWA.

Software Available

New products appear in red.

System Tools:
BUG and uBUG
DESPOOL
DISILOG
DISTEL
EDIT
EDIT-80
FILETRAN
IBM/CPM
MAC
MACRO-80
MINCE
PASM
PLINK
PLINK II
PMATE
RAID
Reclaim
SID
TRS-80 Model II Customization Disk
Unlock
WordMaster
XASM: 05, 09, 18, 48, 51, 65, 68, F8, 400
XMACRO-86
ZAP80
ZDT
Z80 Development Package
ZSID

Telecommunications:
BSTAM
BSTMS
MicroLink-80
RBTE-80

Languages:
ALGOL-60
APL/V80
BASIC Compiler
BASIC-80
baZic II
BD Software C Compiler
CBASIC-2
CIS COBOL (Standard)
CIS COBOL (Compact)
COBOL-80
FORTRAN-80
KBASIC
muLISP/muSTAR-80
Nevada COBOL
JRT Pascal
Pascal/M
Pascal/MT
Pascal/M +
Pascal/Z
PL/I-80
STIFF UPPER LISP
S-BASIC
Tiny-C
Tiny-C Two
UCSD Pascal
Whitesmiths' C Compiler
XYBASIC

Language and Applications Tools:
BASIC Utility Disk
DataStar
FABS
FABS II
Form 1 for CIS COBOL
Form 2 for CIS COBOL
MAGSAM III
MAGSAM IV
M/SORT for COBOL 80
PSORT
OSORT
STRING/80
STRING BIT
SUPERSORT
ULTRASORT II
VISAM

Word Processing Systems and Aids:
Benchmark
MicroSpell
Letteright
Magic Wand
Spellguard
TEX
Textwriter III
WordIndex
WordStar
WordStar Customization Notes

Data Management Systems:
CONDOR
HDBS
MDBS
MDBS:DRS,.QRS,.RTL
dBASE II
PRISM/LMS
PRISM/I MS
PRISM/ADS

General Purpose Applications:
CBS
Selector III-C2
Selector IV

Mailing List Systems:
Benchmark Mailing List
Postmaster
Mailing Address
MailMerge for WordStar
NAD

Financial Accounting Packages:
BOSS Financial Accounting System
Peachtree Financial Packages
Structured Systems Group Financial Packages
GLector

Numerical Problem-Solving Tools:
T/MAKER II
fpl
PLAN80
Analyst
Microstat
muSIMP/muMATH
Statpak

Professional And Office Aids:
Angel
American Software Property Management Package
Cornwall Apartment Management
Datebook
ESQ-1
Guardian
Professional Time Accounting
Property Management
PAS 3 Medical
PAS 3 DENTAL
Sales Pro
Univair 9000 Series Family Medical Management
Univair 9000 Series Family Dental Management
Univair 9000 Series Insurance Agency Management
Univair 8000 Medical Management
Univair 8000 Dental Management
Wiremaster

Books, Periodicals, Accessories
APL —An Interactive Approach
Accounts Payable and Accounts Receivable-CBASIC
The CP/M Handbook (with MP/M)
The C Programming Language
8080/Z80 Assembly Language Techniques For Improved Programming
Fifty BASIC Exercises
General Ledger-CBASIC
H.W.Sams Crash Course in Microcomputing
Introduction to Pascal
Lifelines
Pascal User Manual and Report
The Pascal Handbook
The Pascal Primer
Payroll with Cost Accounting —CBASIC
Structured Microprocessor Programming
Using CP/M—A Self-Teaching Guide
Smartmodem
DC Data Cartridges
Flippy Disk Kit
Floppy Saver
Diskette Drive Head Cleaning Kits
Vari Clean Cleaning Kit

Disk Operating Systems
Software Bus Family
SB-80
CP/M-80
MP/M

Hard Disk Integration Modules

Media and Formats

These are diskette, cartridge disk and cartridge tape format codes, to be specified when ordering software for listed computer or disk systems. All software products have specific requirements in terms of hardware or software support, such as MPU type, memory size, support operating system, or language.
New formats appear in **red.**

ADDS Multivision	RT
Altair 8800	B1
Altos	A1
Apple CP/M-80 13 Sector	RG
Apple CP/M-80 16 Sector	RR
BASF System 7100	RD
Blackhawk Micropolis Mod II	Q2
California Computer Sys 8 in	A1
CDS Versatile 3B	Q1
CDS Versatile 4	Q2
Columbia Data Products 8 in	A1
Columbia Data Products 5.25 in	S4
COMPAL-80	Q2
Computer Ops N C HQ	S2
CPT 8000	A1
Cromemco System 3	A1
Cromemco System 2 SD/SS	R6
Cromemco System 2 DD/SS	RX
Cromemco System 2 DD/DS	RY
CSSN Backup	T1
Datapoint 1550/2150	A1
DEC V118X	SD
Delta Systems	A1
Digi-Log Microterm II	RD
DTC Micro 210A	SC
Durango F-85	RL
Dynabyte DB8/2	R1
Dynabyte DB8/4	A1
Exidy Sorcerer + Lifeboat CP/M-80	Q2
Exidy Sorcerer + Exidy CP/M-80 5.25 in.	RW
Exidy Sorcerer + Exidy CP/M-80 8 in.	A1
EXO	A1
Findex	P6
Heath H8 + H47	A1
Heath H89 + Magnolia CP/M-80	P7
Heath H89 + Heath CP/M-80	P7
Helios II	B2
Hewlett-Packard 125, 5.25 in.	SB
Hewlett-Packard 125, 8 in	A1
IBEX 7100	RQ
iCOM 2411 Micro Floppy	R3
iCOM 3712	A1
iCOM 3812	A1
IMSAI VDP-40	R4
IMSAI VDP-42	R4
IMSAI VDP-44	R5
IMSAI VDP-80	A1
Industrial Microsystems 5000	RA
Industrial Microsystems 8000	A1
Intel MDS SD	A1
Intertec Superbrain DOS 0.1	R7
Intertec Superbrain DOS 0.5-2.x	RJ
Intertec Superbrain DOS 3.x	RK
Intertec Superbrain QD	RS
ISC Intecolor 8063/8360/8963	A1
Lexitron VT1303 DSDD	S8
Lexor Alphasprint Model S1	S1
Meca Delta-1 5.25 in	P6
Micromation	A1
MicroMega 85	SC
Micropolis Mod I	Q1
Micropolis Mod II	Q2
MITS 3200-3202	B1
Morrow Discus	A1
Mostek	A1
MSD 5.25 in.	RC
MULTI-TECH I	Q2
MULTI-TECH II	Q2
Nascom (Gemini drives)	R3
NCR 8140/9010	A1
NEC PC-8001	RV
NNC-80	A1
NNC-80W	A1
North Star SD	P1
North Star DD	P2
North Star QD	P3
Nylac Micropolis Mod II	Q2
Ohio Scientific C3	A3
OKI IF-800	RZ
Osborne 1	SA
Pertec PCC 2000	A1
Processor Technology Helios II	B2
Quay 500	RQ
Quay 520	RP
RAIR DD	RE
Research Machines 5 25 in	RH
Research Machines 8 in	A1
Sanco 7000 5 25 in	RQ
SD Systems 5.25 in	R3
SD Systems 8 in	A1
Spacebyte	A1
Tarbell 8 in	A1
TEI 5.25 in.	R3
TEI 8 in	A1
Televideo DD/DS	S5
T I.P (Alloy Engineering, Inc.)	T3
Toshiba T200	SF
TRS-80 Model I Standard	M-R2
TRS-80 Model I + Shuffleboard 8 in	A1
TRS-80 Model II	A1
Vector MZ	Q2
Vector System 2800	A1
Vector System B	Q2
Vector VIP	Q2
Vista V-80 5.25 in. SD	R8
Vista V200 5.25 in. DD	P6
Wangwriter	SE
XEROX 820, 5.25 in.	S6
XEROX 820, 8 in.	A1
Zenith Z89 + Magnolia CP/M-80	P7
Zenith Z89 + Zenith CP/M-80	P7

COMING SOON!
ARCHIVES 1
AVL Eagle II
Commodore CBM/Pet 2000/3000/4000 Series
Commodore CBM/Pet 8000 Series
Dysys ESC 4500
EXO
Heurikon
Heuristics
MULTI-TECH III, IV
Nascom/Lucas
NCR 2950
Northern Telecom 503
Pet/CBM 2000/3000/4000 Series
Pet/CBM 8000 Series
Philips P2000 with MMU
Solid State Technology
Toshiba T250
TRS-80 Model III
Zeda 580

Single-sided single-density disks are supplied for use with double-density and double-sided 8″ soft sector systems.
IMSAI formats are single-density with directory offset of zero.
A media surcharge will be added to orders for the following: Tape formats T1 and T3
The list of available formats is subject to change without notice. In case of uncertainty, call to confirm the format code for any particular equipment

Note that Lifeboat programs have specific hardware and memory requirements but will run on most CP/M machines with 48 KByte available.

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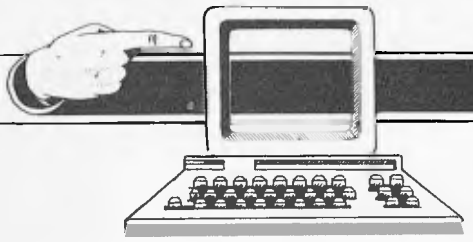


MICROMARKET

More than once a day, our office receives a call regarding machine specifications or availability or requests for advice on software, so we've decided to release an updated version of MICROMARKET and complement its bi-monthly appearance with a new section called PACKAGES. The first appearance of MICROMARKET will be in the September issue of APC followed by PACKAGES in October, each being published thereafter in alternate months.

MICROMARKET will be a comprehensive list of all microcomputers available in Australia including single board micros, and kits. There will be five main headings under which the most important specifications of each machine will be listed.

For space reasons it would be impossible to list all prices and configurations of available microcomputers, so the minimum configuration and its price will be listed. Where disk drives, speech synthesiser or graphics cards, for example, are available, they will be listed in the "Miscellaneous" column with the relevant price.

A number of abbreviations are to be used and they are listed in the table below.

The following example shows the order in which components, options and software will be listed. We ask that companies submitting information do so in the standard form shown, using abbreviations wherever possible.

MACHINE (PRICE FROM)	MAIN DISTRIBUTOR/S (NO. OF DEALERS)	HARDWARE	SOFTWARE	MISCELLANEOUS (DOCUMENTATION) (BENCHTEST DATE)
Full Name of Basic Machine (Minimum Retail)	Name of Main Australian Distributor (No. of Dealers Including Franchised Dealers)	RAM : PROM : EPROM Processor/s: C : Disks (Capacity) (either F/D or H/D if standard : TV Int : P/P (incl. no. of ports) : S/P (incl. no. of ports) : G/c : Tone Generator	Standard Languages : Optional Languages (listed in italics)	The contents of this section will be left largely up to the supplier. (One of the following abbreviations will be used to describe the general level of documentation : E, H (i.e. hardware details included), I S (i.e. Details of ROM included). BP – Date of full APC test).

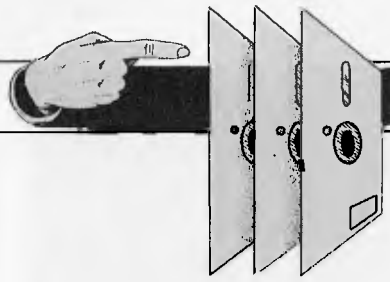
List of Abbreviations

A	Assembler	G/C	Graphics Card	M/A	Macro Assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are inclusive of Sales Tax.

This is an example of how an entry will appear in MICROMARKET:

MACHINE (PRICE FROM)	MAIN DISTRIBUTOR/S (NO. OF DEALERS)	HARDWARE	SOFTWARE	MISCELLANEOUS (DOCUMENTATION) (BENCHTEST DATE)
Tandy TRS-80 Color ($599)	Tandy Electronics (02) 638 6633 (200)	4–16k RAM : 6809 : 8–16k ROM : C : 16 x 32 TV int : RS232 port	Color Basic : Extended Color Basic	With 16k RAM, 16k ROM & Extended Color Basic $250 (I). BT 1/82
TRS-80 Level I ($499)	Tandy Electronics (02) 638 6633 (200)	4-16k RAM; Z80; C; 12", 16x64 optional: B/W VDU	Basic; Games: A	Basic in 4k ROM; upgradeable to Level 2 (I)



PACKAGES

This software directory will be confined to business packages which have been in use for at least six months in a minimum of five sites.

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in a separate table.

So, the directory will be divided into two sections. The first will index software packages according to application. If you require a program to provide credit control, then under this heading you'll find a list of machines for which this software is available and a code referring to the package's supplier.

The second section will be an alphabetic list of microcomputers. Under each machine will be a list of available software packages and supplier code, so that if you are contemplating the purchase of a machine or already own a computer, it will be easy to identify available software.

Producers of packages which fall within the first mentioned constraints should send details to PACKAGES, *APC*, P.O. Box 115, Carlton, 3053. We require only the category of application, computer for which the package is intended, price, supplying company name and telephone number.

Below is a suggested list of applications (CP/M and other widely used operating systems are listed as separate "microcomputers" because of the large amount of software written specifically for them).

Applications

Appointments Planner
Assembler dev
Bank accounts
Bill of materials
Bonds/pension quotations
Budgeting package
Bureau de change
Cash flow
Cash register
Company secretary
Container accounting
Contract costing
CP/M & utilities
Credit control
Customer file
Database management/
Information retrieval
Dental Records
Disk operating system
Estate agent
Equipment lease/rent/HP
File Handling
Financial modelling
Financial planning
General ledger/NL
Hotel management
Incomplete records
Industry Factory loading
Industry work study
Integrated accts
Investment portfolio
Invoicing
Job costing
Job order control
Legal precedents
Letter writer
Lotteries
Mailing List
Mail shot
Membership acctng
Motor Dealer
Order entry/invoicing
Order processing
Office admin
Pad to plotter systems
Payroll
Perpetual Inventory
Personnel records
Petaid report generator
Planning/Maintenance
Postal advertising
response package
PR/advertising package
Price lister
Printers job control
Production analysis
Prof appts groups
Prof appts individ
Prof client billing
Programming aids
Property management
Purchase ledger
Quotation estimating
Sales ledger
Salesman
Sales Tax analysis
S/L, P/L & stock control
Solicitor's complete
record accounting
Solicitor's package
Statistics
Stock control/recording
Surveying
Text file librarian
Time/cost recording
Travel agency accts
Travel Agents Diary
Travel Ticket Sales
Utilities
Utility set
Various engineering
Vet package
Video message
Warehousing
Word processing
Work in Progress

MICRO VISIONS

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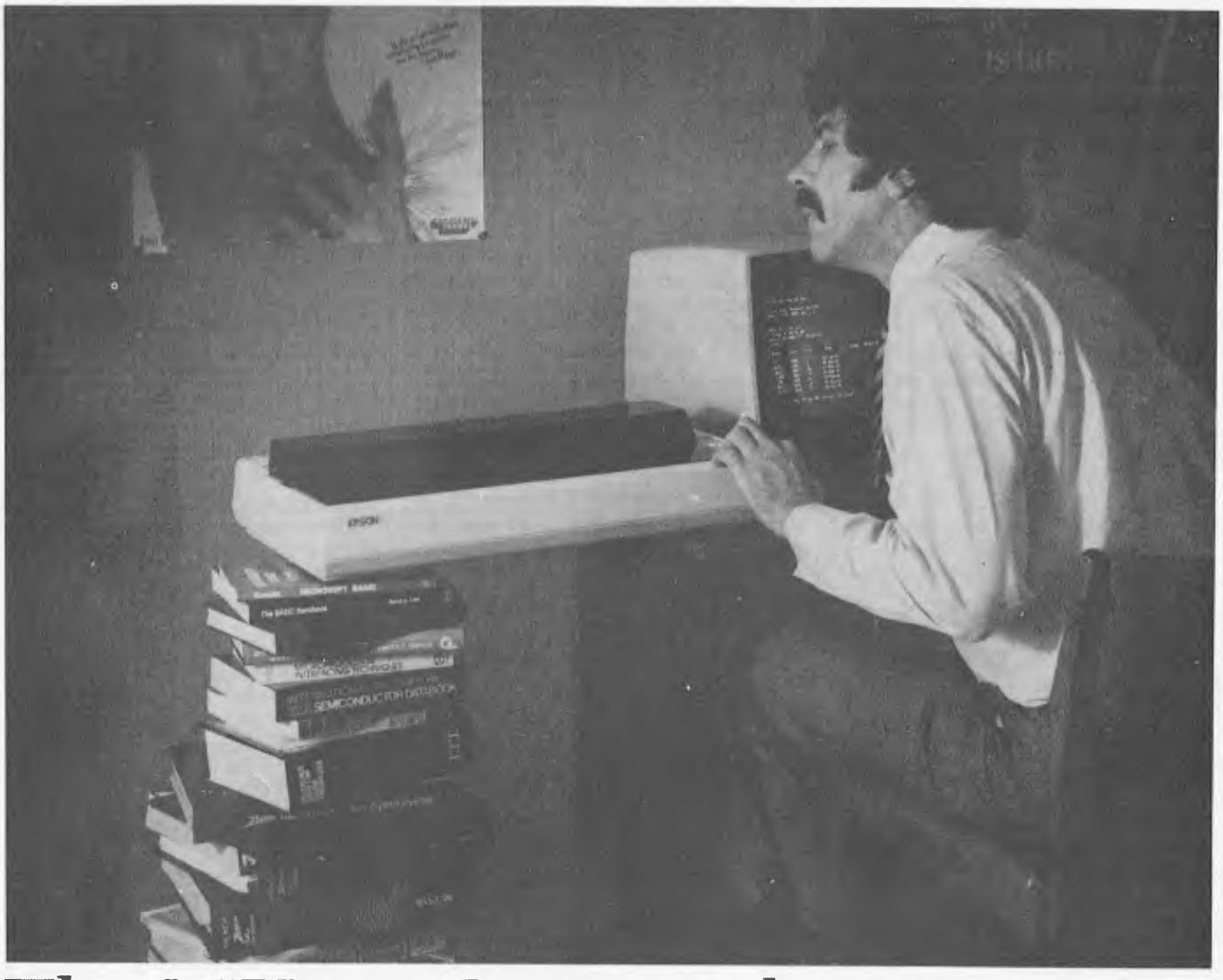

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FRAMES OF REFERENCE

A DP MANAGER'S GUIDE TO MICROS

By Alan Wood

PART 6: PUTTING YOUR MICRO TO WORK

It is easier to determine what microcomputers are not good for than it is to describe the numerous applications for which they are suited. Micros are not good for handling vast files of data, for handling many users simultaneously, or for handling huge number-crunching tasks. The practical hardware limits of today's micros are: 1 megabyte of RAM, 100 megabytes of disk store, eight users on a multi-user system or about 24 single users on a network.

The software limitations of micros are more significant than the hardware limits. The development of a multi-user or network operating system is not a trivial task; such software takes many years of talented design and programming to produce and many more years before it is largely debugged. Some of the offerings in the micro market are simply not credible, although there are excellent examples of software, eg, the Unix implementations and Xionics Xibus/Xinet. The software available on micros is lacking when it comes to organising and getting rapid access to data in large files. There are few languages and operating systems with even ISAM facilities and there are fewer database management systems.

It is important to get the limitations of microcomputers in perspective before you consider their application and place in your company. It is also helpful to start with a working definition of the operational differences between computers:

A mainframe is a computer which requires an operational department to run it.

A mini is a computer which requires an operations manager to look after it.

A micro is a computer which is operated by its user.

Microcomputers offer a number of benefits compared to their computing antecedents: rapid delivery... from one to four weeks; low entry cost. . . £6000 for a complete single user system that could grow to a 24-user network; fast implementation. . . complete small systems installed three months from order and no system installed in longer than six months; package abundance. . . low cost implementation and maintenance; physical size. . . micros pack more and more power into desktop units — yesterday's mini literally fits into today's desk.

The disadvantages of microcomputers in the hands of users can be described as:

1. Publicity greater than performance . . . microcomputers do not equal mainframe computers; the cost of a system does not equal the cost of the hardware — personal computers are good as super-calculators but not as file processors.
2. Users are not disciplined enough to have own computers. . . floppy disks get lost/disorganised, data backup is not taken regularly if at all, hardware is abused with dust, coffee and crumbs.
3. Hardware and software limitations not understood. . . a little knowledge leads to doing dangerous things, DP departments adopt a 'not invented here' attitude and refuse to get involved/help until the user is humbled by mistakes.
4. Surreptitious microcomputing. . . micros sneaked in by users, little, no or fallacious justification, self-indulgence in doing interesting things in computing (previously the prerogative of DP people only!).

Applications

In addition to familiar data processing tasks, the cost of micros justifies new applications which were previously uneconomic, impractical, or low on the priority list. Data processing departments have seriously underestimated the role of micros, associating them with game playing and trivial tasks. Microcomputers are extensively displacing and supplementing timesharing services with significant cost savings; they are replacing tasks previously undertaken on minis, much as minis usurped the position of the low-end mainframes; and they are pushing computing facilities further up and down organisation hierarchies . . . the first computer on the director's desk is often a micro.

The computer manufacturers of the '50s and '60s found an eager market in the commercial and industrial companies whose operation and expansion was inhibited by manual systems. The first systems they installed were a computer replication of what was there already. Then the systems became more sophisticated, reflecting new services companies could offer, such as credit card facilities and airline reservations. The increasing complexity of those systems led in turn to bigger computers. At the same time, the individual manager's job grew in complexity to a point where computers were needed to aid decisions. The data needed for those decisions is not easily abstracted from traditional data processing systems in the format the manager needs. Consequently, the microcomputer manufacturers have found an eager market among professionals in large companies hungry for computer assistance. The microcomputer is excellent at handling the top layer of management information. It can be applied to taking a lateral view of data in a hierarchical data processing system. It can be applied to calculating and assembling data in a digestible form. In the hands of an intelligent user it functions as a brain-extender to help reduce costs, make better returns on investments, sharpen negotiations and provide 'considered' responses more quickly.

Personal and company systems

It is important to distinguish between the personal and the company system, between personal data and company data. Personal data can be defined as 'unique to an individual'; company data is 'integral to the company'. An engineer working on a project will have data unique to him on which calculations need to be performed. Similarly, scientists, managers, accountants and executives have unique data requirements. The needs of this group can be partially satisfied by a personal system which has some of the following characteristics: uses unique data; is applied as a super-calculator or electronic file index; encourages computer literacy; supplements/replaces timesharing service; prepares for future electronic office; uses programs and packages which do not require central support.

One danger associated with personal systems is that managers will spend more time learning programming and playing with computers than managing. In practice, what is tending to happen is they put in extra hours in the evening and weekends and also encourage junior office personnel to become computer literate. A more significant danger is the creeping system: the simple personal system which creeps into a company system with all the dependencies that this implies but none of the essential standards or controls.

Company systems are by definition not unique to an individual but integral

to a company. They develop as the company develops and they require control and support. If the company system's operator, manager or user leaves it is essential that the system can be passed on, understood and operated by his or her successor. Micro-based company systems are similar to traditional data processing systems, even if they are used like 'link-less' terminals. There are many examples of such systems. They lend themselves to company-developed packages which can be used at a number of sites: warehouse stock location, local stock recording, stock taking; 'specials' purchasing, goods receipt; personnel records, career/salary administration, graduate recruitment; depot, division, department, and branch record keeping; quotations, contracts, proposals and project administration.

Fertile areas for micros

The 'no-man's land' for microcomputers is between what users want and the border with existing mainframe systems. If you leave aside that territory, there are still acres of applications untouched by existing company systems. Two of the most rewarding areas are office systems and timesharing replacement, sometimes in combination.

The functions performed in offices up and down the country are basically similar. The typically comprise calculating, record keeping, typing and communicating via telephones and mail. These functions suit standard systems and packages because they are so alike.

The off-the-shelf microcomputer can perform most office functions using packages, with a few tailored programs to meet justified special needs. There is a variety of standard calculation aids, such as Visicalc and Supercalc. There is a choice of information managers from the simple electronic index (eg. Visidex), to the more detailed electronic file cabinet (DMS). Word processing packages abound, often in combination with record keeping (Wordstar) and with other facilities like spelling dictionaries (Spellguard). A feature of networked micros is the ability to send messages to other users of the network, such as Nestar and Xinet. Micros can also be used with acoustic couplers and modems to communicate messages over the public telephone system, so authors creating text on a home computer can send it down the line to the publishing house central machine.

The point has already been made about the limitation of the micro as a super number-cruncher. Timesharing services thrive on the software and databases they offer; they will continue but cursory analysis reveals that many of the smaller programs can be run on micros and many of the new micro packages offer a top cut off the timesharing service at a fraction of the cost.

The trend began with tools like Visicalc, a rows-and-columns program providing a matrix of 64 columns by 200 rows, automatic re-calculation facilities and a variety of mathematical formulae. Visicalc is much friendlier than timesharing programs which do not provide screen interaction. It has been followed by a variety of other aids — Micro Modeller for financial modelling, Micro-Planner for critical path applications, Optimiser for linear programming. More management aids and personal productivity programs will follow. The 16-bit desktop micros with these programs will eat further into timesharing spend. Using micros for front-end data entry is also an economic extension of your timesharing service, so that you keep connect costs and phone bills down. The added facilities that the micro provides off-line combined with use as a terminal are valid justification.

In some departments dedicated word processors are required, eg, updating from a typing to a word processing pool. In others, the general-purpose microcomputer with word processing software provides an economic and versatile solution. At today's prices, $9000 buys a high-quality micro with a daisywheel printer and word processing software. The software is not as friendly or as feature full as the specialist word-processors, but the fancy features for which those machines are bought are seldom used. Applications combining data processing, word processing, information processing and number processing are ideally satisfied by microcomputers. A small bonus (or hazard, depending on your point of view) is the extension of keyboard skills in the organisation and the dispersal of some typing to two-fingered word processing users.

Data processing on micros

It is in their application in data processing that microcomputers cause most agony, antipathy and indecision in larger companies. Just how far should you let them go or grow? The hardware and, particularly, the software limitations of micros automatically exclude them from many applications, although the boundaries are being pushed steadily outwards. The cost of converting software on existing systems is another natural boundary to micro encroachment. Then there is the preservation of computing skills and all those hard-learned standards and controls built up over the years. And superimposed on the top is the company organisation and computing policies. Is yours a heavily centralised organisation, with controls flowing outward from the centre? Or does your management favour operating in relatively autonomous groups with just top-level financial controls?

In the Big Brother company, the best micros to use are the first level personal computers, perhaps with mainframe communication. In the Little Brother company, there is a lot of scope for more powerful micros. The network of micros has a place in both centralised head offices and in despersed organisations.

For the most part, ledger applications will be well taken care of and will be much too big for micros. However, some of the small business subsidiaries of big companies can fit quite nicely and quickly on to a microcomputer. Examples are overseas or remote small companies, companies acquired in a takeover, companies set up to market a new product of service. Another common application for micros in large companies is executive payroll — often a tedious job for the company secretary or financial controller.

There's a whole variety of standard application packages for ledger applications so it should not be necessary to develop special software, other than a small number of tailored programs.

The minicomputer made great headway as a machine dedicated to regional and branch order processing and stock control. The micro is equally successful for smaller order processing systems, as a single-user, or networked configuration. A number of big companies use micros for local stock control and repeat the same system in lots of locations, eg, Shell. Purchase order processing, particularly specials as opposed to bulk purchasing, is a common micro application in the larger company.

Teletype communications and 2780 and 3270 emulators provide the means of connecting microcomputers to mainframes. The other popular protocols are gradually appearing from computer manufacturers and from independent vendors. The availability of such software removes one of the main deterrents to DP applications on micros; the micro becomes simply an extension of the existing facilities. A microcomputer used locally for a variety of tasks can be switched to an intelligent terminal to talk to, and receive data from, the mainframe computer. As more protocol software becomes available, micros will be used to replace expensive emulation terminals.

Multi-function applications

The microprocessor is overturning the traditional approach to multi-user, multi-tasking computers in a number of ways and providing new options in multi-function computing.

The mainframe and minicomputer solution to providing access for many users to an information facility has been to share central memory and store. A sophisticated operating system handles the management of many users and tasks, apportioning part of the memory and store to each task, handling queues of users and protecting files from corruption through simultaneous access by more than one user. Advanced multi-user computers partition and use virtual memory, allocate priorities and have extensive security and data management features, all of these housekeeping tasks consuming an increasing proportion of the power of the computer — for example, if you have an IBM environment you virtually need one machine to manage CICS and IMS and another machine to run your applications.

Multi-user and multi-tasking

There are two solid justifications for large computers for multi-user work. The first is where a vast amount of data has to be stored and manipulated. The second is where many people must share data and have access to it at the same time; the classic example is airline reservation systems.

FRAMES OF REFERENCE

The justification of multi-tasking — the performance of many jobs simultaneously by one computer — is based more on economics than the need for big computers *per se*. Multi-tasking can still be justified where it is more economic to fulfil applications on one big machine, rather than on a series of small ones. If the applications are up and running, it may also be cheaper to keep them there because of software conversion costs. However, if the applications have not yet been implemented, or have to be updated, or the computer has to be changed, a series of machines performing one or more different tasks can provide a highly resilient, economic and responsive solution.

There are two simple examples of multiples of microcomputers being used to satisfy requirements economically and securely. Firstly, when the tasks become too many for one machine in an office, a second machine can be installed to meet the expanded requirement. Secondly, when the same jobs have to be repeated in different locations, the distributed microcomputer can be the ideal solution. Set up to produce quotations, keep stock, run an estate or personnel agent's office in one location, the microcomputer can be cloned for as many sites as is economically justified.

The essential characteristic of distributed micro systems is that users do not need simultaneous access to the same files. Transfer of floppy disks from one machine to another or telecommunications to a central point is sufficient to satisfy occasional sharing of information. Because we are used to thinking of traditional multi-user file sharing, we too often jump in that direction without examining the options sufficiently. Even micros stacked one on top of the other can provide more resilience and take up less space than one multi-tasking computer.

Where it is vital for a small number of users to share the same files, a multi-user microcomputer can be employed. On 8-bit single processor machines, the practical limit is about four terminals. The multi-user features are achieved in differing ways; for example, by switching from one bank of memory to another, dedicating memory to each attached terminal. On a bank-switching system, the users share disks and operating system. Speed of response depends on disk speeds, sophistication of operating system and the cleverness of the programmer. Hard disks are essential to provide adequate data storage and response and backup should be available by tape or exchangeable disk. More advanced 8-bit multi-user microcomputers provide several processors to support multiple users.

On 16-bit micros with Unix derivatives or own operating systems, the limit is 16 users and the typical load is 6-12. On these machines input/output is a greater limitation than processor capacity since most typically operate with only one disk channel. They are well suited to multi-user information management and word processing tasks where all operators must share the same files but where transaction levels on individual records are not very high.

To improve resilience and efficiency and to capitalise on microprocessor costs, tomorrow's special and general-purpose machines are being built on a honeycomb of microprocessors, with each cell performing or duplicating a function, all intricately interconnected.

Existing computer users have a wide variety of options and constraints with regard to microcomputing. Should they: connect micros to mainframes?/use micros as 'linkless' terminals for remote tasks?/use micro networks?/or interconnect micros with word processors, minis, mainframes? The new users also have many options; should they choose multiples of micros, a multi-user micro or a micro network to satisfy their needs? There is no absolute answer for either the existing or new user, other than selecting a reliable system at the bottom end of its capability so that it will grow with your needs. The key words are 'reliable' or 'proven' at the 'lower end' rather than at the extremities of what suppliers claim. These requirements limit choices and ease the process of selection, once the more difficult decision is made about what conceptually will suit present and future needs.

More radical thinking

So far we have taken a traditional approach to the new computing, carefully matching capabilities and limitations with possibilities and constraints. Some managers are more radical in their approach to take full advantage of powerful low-cost micros. Forget for the moment that you are constrained by years in DP and by all the computing paraphernalia your organisation has accumulated. Without those trappings, how would you proceed?

Starting at the baseline in your organisation, you could equip every worker from director to office administrator with a computer which would occasionally connect or feed into a central hub. Everywhere you see a typewriter or find a calculator, install a dumb terminal; everywhere there is a telephone, and a few more places besides, you could put in a micro. Connect them by cables and you have a computer utility. Connect your cable to existing minis, word processors and mainframes and you have closed the loop on existing computing. The technology, products and costs are such that radical-thinking managements are achieving or planning this computing scenario now.

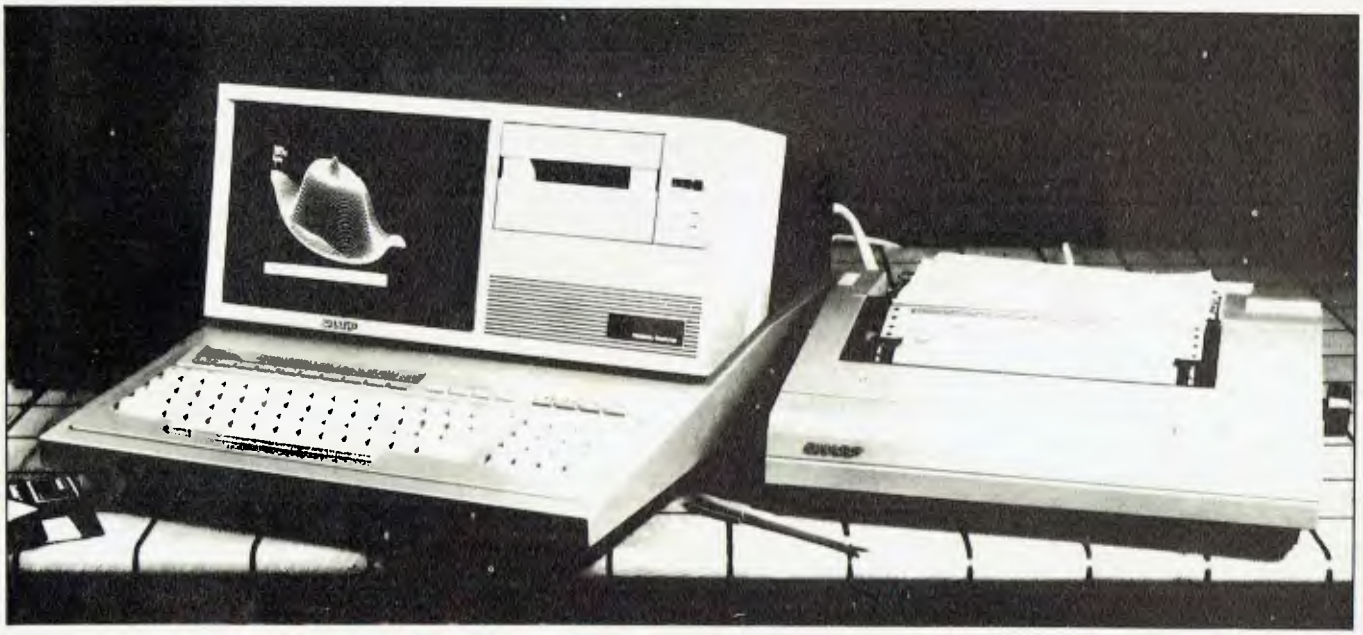
The costs of personal computers are comparable to the costs of quality electric typewriters. A network of microcomputers providing calculating power also facilitates inter-office communication. The choice for the larger organisations lies between allowing a piecemeal approach or developing a rational architecture for the 80s which will fully employ new technologies linked to existing computing.

The sixth commandment of microcomputing

Thou shalt not treat micros as transaction processing machines. Micros are at their best as single-user or multi-function computers on which each user is processing a discrete task. Micros are ideally suited to office systems, time sharing replacement and intelligent workstation tasks. They are not suited to transaction processing where many users want to simultaneously access and update the same files and records — eg, order processing.

'We feed the geological data for the area, the computer produces a schematic topological overview designating high probability key points, then we stick the printout on the wall and Johnson here throws a dart at it.'

BENCHTEST
COMPUTER SYSTEM

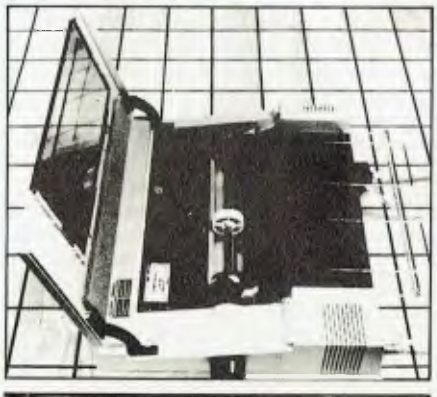


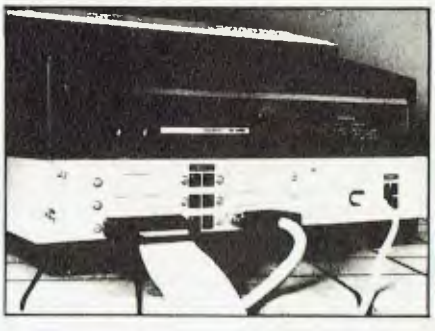
JACK OF ALL TRADES, MASTER OF MOST...

Dick Pountain finds the Sharp MZ80B lives up to its 'general purpose' tag

Way back in December 1980, APC looked at Sharp's first entry into the world micro scene, the MZ-80K. Developments have moved quickly since then. The MZ-80K was not released in Australia; it was replaced by the MZ-80A, which also was not released in Australia. Both of these machines were aimed at the low-cost end of the market.

The only Sharp micro to reach Australia in the past has been the PC 3201. But now the company is making amends with the release of the MZ-80B, a more "up-market" product than the earlier models in the series. Dick Pountain investigates.





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Sharp brings you the MZ80B. A machine that offers you functions previously associated with more powerful, more expensive computers, that gives you versatility to handle a huge range of software and hardware applications in scientific, business and personal use.

The MZ80B opens up a new world of graphic display potential, more flexible data storage and retrieval, and ease of operation.

Here is the computer from the future. Available today.

Stunning Graphic Display

Seeing is believing. The large-screen high-focus, green-face incorporated in the MZ80B gives you high resolution graphics of 320 x 200 dots.

An additional graphic RAM is included which allows another 320 x 200 dot resolution pattern to be displayed.

This dual high-resolution graphic ability is especially useful for stimulating and displaying a dynamic picture, it can display 40 characters x 25 lines or 80 characters x 25 lines via software switching.

In addition, there are facilities for full, on-screen editing, reverse video, partial scrolling and a full range of graphic symbols.

Character and Graphic Printer

This fast, quiet printer will reproduce your graphic displays and, of course, print-out upper and lower case letters and symbols. A tractor/friction feed version is also available.

Data Storage/retrieval

The MZ80B has a remarkable memory. 64K of RAM. And that constitutes all the memory area, giving flexible storage of any computer language and its software.

The cassette deck is electromagnetically-controlled, with a data transfer speed of 1800 bits/sec. combined with a unique programme search facility to make data storage and retrieval super-fast.

Software

Software includes Basic compiler, PASCAL, COBOL, FORTRAN and numerous accounting applications.

Floppy Disk Drive

A twin Floppy Disk Drive unit can be added which will give you 560K bytes of storage on double-sided, double-density disks.

Comprehensive Documentation

Each MZ80B comes complete with a full set of documentation including an owners' manual giving full circuit diagrams, a monitor reference manual and programming manuals.

Interfaces

RS232C and IEEE Interfaces are available allowing the MZ80B to communicate with scientific instruments and other peripherals.

CP/M* 2·2

CP/M* is also available making a wide range of packages immediately available including wordprocessing, financial modelling, data base management to mention but a few. CP/M* also increases the disk capacity to 680K bytes.

(CP/M* is a Trade Mark of Digital Research Ltd.)

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CASSETTE – BASIC with every purchase of the SHARP MZ80b

PC-1500

ROM: 16K bytes
RAM: System area: 0.9K bytes. User area: 2.6K bytes

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My deepest impression after a few hours with the MZ-80B is that this is probably the machine that Sharp's design team wanted to make when they worked on the 80K. All the compromises inherent in that design, presumably to bring it in at a price acceptable to the PET buyer, have been abandoned and the result is an integrated system, rather than a computer plus afterthought peripherals. In external appearance, the 80B shows evidence of Sharp's hi-fi connections along with a distinctly Italianate line far removed from the rounded Star Wars look which is the current Japanese vogue. This long low look is assisted by the 9in rather than 12in CRT and the absence of on-board disk drives.

The base/keyboard unit is of pressed steel (to help shield RF emissions?) with a hi-fi style shot-blasted finish, while the pedestal containing the VDU and cassette-drive is in ABS plastic cunningly metallised to an identical finish. This pedestal swings up and forward on removing two screws to yield access to the internals and has a car-bonnet-like support to keep it open. A peek inside reveals a neatly packed array of nicely finished boards with much use made of nylon clip fasteners and ribbon cable connectors. The CPU (a Z80A running at 4MHz), PIO and various support chips are socketed, but the 32k of dynamic RAMs (4116s) on the CPU board are soldered. The expansion RAM is all socketed. At the rear right of the case is a six-slot bus expansion cage with six corresponding ports for I/O connector sockets. Two of these were occupied on the test machine by the interface cards and sockets for the disk drive and printer (which uses Sharp's own 8-bit parallel interface); RS232 and Centronics will be available in due course, but at present the '80B only accepts Sharp's own MZ-80P5 printer. A third slot is taken up by the optional second graphic memory card.

The full-size typewriter keyboard has a standard layout with extra control keys, a separate numeric pad and good pitch and feel. In addition to a proper space bar, a small TAB key is provided alongside for fast table entry. Break, Insert/Delete and Clr/Home are on the main keyboard with three levels of shift; Shift gives lower case, Grph gives 30 graphic symbols and Rev gives reverse field characters (but not for the graphics). The two latter keys and Shift lock have built-in red LEDs to warn that they are engaged. For touch typing, the Shift can be altered by the Basic command CHANGE to give upper case. Above the main keyboard are ten user-definable keys, four cursor control keys and four cassette control keys. On booting up Sharp Disk Basic, the user-defined keys default to ten Basic commands whose repertoire can be inspected by KLIST. In fact most of the keyboard is software-defined; in Sharp Basic there is no repeat on any keys except the cursor controls, but under CP/M all keys repeat, while in Wordstar the user and numeric pad are assigned to control characters as well.

The 9in green screen display is software-switchable between 40 and 80 characters per line by 25 lines; the characters are 8x9 and have true descenders. At 80 per line, text is quite legible but marginally harder on the eye than 40. The screen is memory-mapped three times over; a 2k video RAM provides for the display of the ASCII characters echoed from the keyboard in normal fashion. In addition, there are two 8k graphics RAMs (the second is optional) which independently map the screen as a 320x200 high resolution dot-addressable display; all three of these video stores reside outside the 64k of user RAM and are switched in and out of the memory map by a Z80A PIO (parallel I/O controller) device. The 'character RAM' is always enabled but either or both of the graphics RAMs may be written to — or displayed under program control. The screen can be thought of as having a foreground of characters and pixel graphics and two separate 'backdrops' of hi-res graphics, the combination of which allows some very fancy displays.

As you might expect, this facility complicates the memory management of the '80B more than somewhat, but the resulting juggling of page addresses is handled in a user-transparent fashion by the PIO and a PPI (programmable peripheral interface) device so that you always see 64k of contiguous RAM starting at 0000H. Switching between character RAM and graphics RAM 1 is performed by the PIO and between graphics 1 and 2 by OUT port F4H. Should a program access graphics RAM while lying in that part of RAM (above D000H) which would normally be disabled by the PIO, there's no problem; the graphics RAM addresses are changed to begin at 5000H. A similar conjuring trick is performed by the Initial Program Loader on boot-up to allow the boot ROM into the memory map. The result is an unprecedentedly 'clean' machine with all 64k available to the user. The graphics are not particularly fast, which is hardly surprising considering the amount of interrupting that must be going on. It takes six seconds to SET 1000 points.

There is no resident software other than a 2k bootstrap loader in ROM. If a system disk or cassette is present then booting follows automatically on power-on or by pressing the 'IPL' button on the back of the case. Next to this is a separate RESET button which puts you into the monitor without clearing the Basic text area; very handy for recovering from a crash. Booting Disk Basic or CP/M is satisfactorily quick at four seconds and tape Basic is quicker than one expects (105sec) since the cassette drive transfers at a fast 1800 bits/sec. All the tape functions, including FFwd, Rewind and Eject, can be under program control and searching is performed at FFwd speed. Folk of nervous disposition may suffer a nasty turn, however, when the cassette hatch pops open of its own volition in the middle of a program!

Aural stimulation is catered for by an audio amplifier and loudspeaker set in the facia below the cassette hatch. The volume is controllable by a knob at the rear and goes up to well past annoyance level. A music 'language' is incorporated in the Basic which allows programming of pitch and duration but not of volume or envelope.

The dual double-sided disk drive is the same hardware introduced for the MZ-80K but, thanks to a new controller card on board the 80B, it no longer requires an interface box and provides twice the capacity (280k per drive under Basic, 340k under CP/M) through double density. It worked without a hiccup during the test even when fed supposedly single-sided disks.

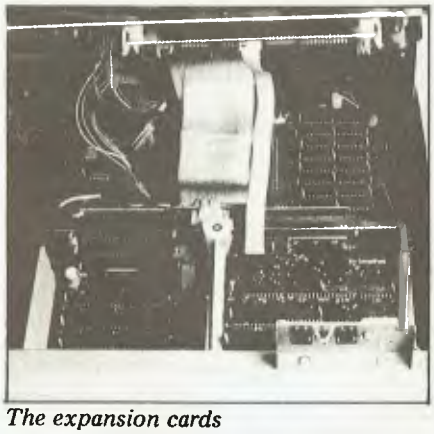
The printer supplied was the new MZ-80P5 which looks and acts remarkably like an Epson MX-80 in Sharp's own case, which is sharply (sic) styled to match the computer. Attached through a 24-pin connector cable, it can print all the graphics including user-defined symbols as well as half- and double-width text. It uses fan fold paper from 4 to 10in and ribbon cassettes.

All the necessary connectors are supplied, including braided earthing wires between units. Each unit requires its own mains lead which is a nuisance; a firm that also makes racked hi-fi ought to have found a neater solution.

Software

The 80B was supplied with two Basic interpreters (single and double precision) on disk and one on cassette, Pascal on cassette and Sharp's FDOS operating system together with demonstration programs including stock control, word processing and various fancy graphics demos. In addition to this rather overwhelming plethora of Sharp's own software, the machine came with a sample of its implementation of CP/M 2.2 for the machine, along with Wordstar and Datastar.

The single precision disk Basic, SB-6510, is not compatible with versions for the MZ-80K, though a converter program is available so you can run '80K software. It takes up 21k and is booted up automatically along with the 4.5k monitor by the IPL system, in about four seconds. It consists of a 'kernel' of commands which are a fairly standard, though by no means luxurious, implementation of the language together with extensions which



The expansion cards

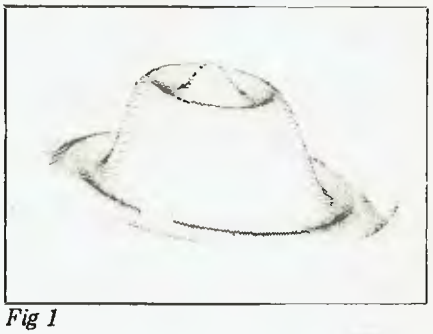


Fig 1

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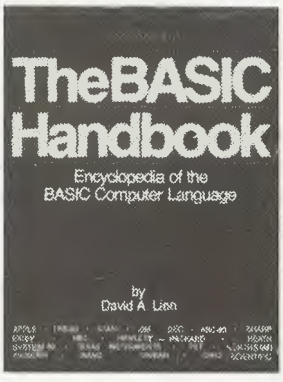
THE BASIC HANDBOOK
by David A. Lien

The purpose of this book is to assemble the most complete collection of BASIC words ever, and then describe strategies programmers can use to convert the many different "dialects" to their computers. The result is a working handbook that will vastly expand your computer's capabilities. This new second edition includes explanations for almost 500 BASIC words used by computer makers world-wide. The author also attacks the problem of incompatibility by carefully outlining strategies by which programs can be converted to other computers.

1981; 471pp; $26.95



DATA FILE PROGRAMMING IN BASIC
by LeRoy Finkel and Jerald R. Brown

Data files are *the key* to effectively using microcomputers for virtually all business, classroom management, professional, and sophisticated home applications. Yet surprisingly few micro users understand how data files work, and fewer still are able to set up and maintain them for their own use. This easy-to-follow book is the first self-instructional manual designed for the thousands of business and professional users and computer hobbyists who want to add this powerful tool to their computing capabilities. It shows you - in comprehensive and comprehensible detail - how to program and maintain data files on microcomputers, and how to write data file programs that are readable, efficient, and *useful*. The book uses TRS-80 BASIC and Microsoft BASIC-80.

1981; 342pp; $13.95

MICROCOMPUTER DATA BASE MANAGEMENT
by E.G. Brooner

This is a practical, hands-on approach to data base management for: the microcomputer owner/user; Manager; Small Business Owner/operator; Scientist; Computer Professional; and Computer Science Student. It provides tutorial information on file handling, sorting, searching, linking and hashing. It reviews, explains and evaluates three commercial data bases and includes self-help test questions and exercises. An example of the simultaneous use of several data files - fixed assets, inventory, payroll and financial accounting is given.

1982; 158pp; $18.95

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IBM'S Personal Computer will soon be in Australia. This book provides detailed information.

IBM'S PERSONAL COMPUTER
by Que Corp.

This book about IBM's new Personal Computer will be helpful to business managers, computer professionals, and prospective buyers of the Personal Computer. Written to be clearly understood by non-technical persons, but crammed with all the detail a professional needs, this 320 page bestseller offers an opportunity to learn where the IBM Personal Computer fits among the many personal computers now available.

Que's unique business software evaluations thoroughly describe IBM Easywriter, IBM VisiCalc, and the IBM Peachtree Accounting Series. These software packages are evaluated in all important categories on a scale of 1 to 10. Function lists show the software capability in detail.

Useful appendices compare CP/M 86 and PC DOS, and list all PC BASIC commands and statements. They also list outside sources for enhancements, peripherals, software and publications. Illustrations include 34 photographs and 32 detailed tables.

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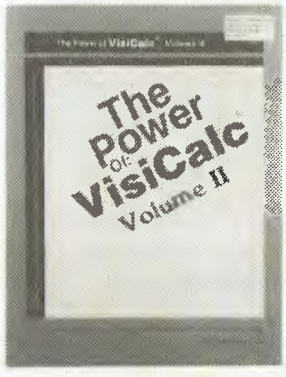

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by W.S. Davis

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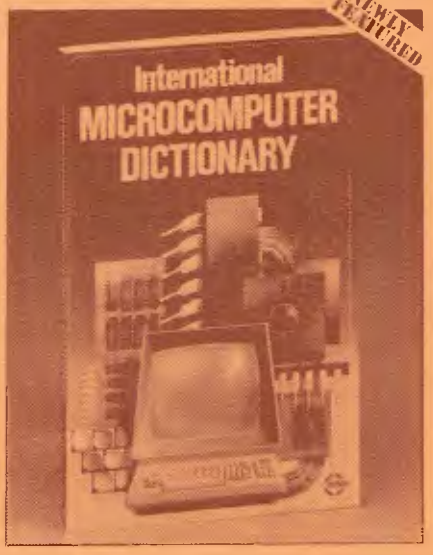

International Microcomputer Dictionary $4.95

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LEVEL: Elementary assembly-level programming (level of C202) required.

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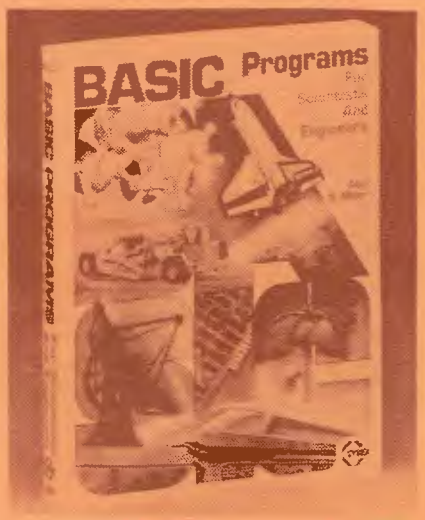

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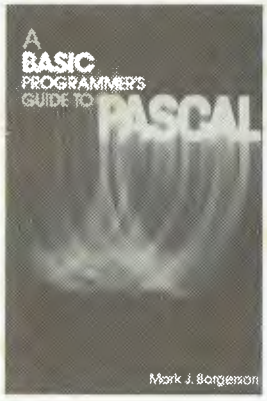
A BASIC PROGRAMMER'S GUIDE TO PASCAL

by Mark J. Borgerson



If you're an experienced BASIC programmer who's ready to move up to Pascal, then this book was written for you. It shows you how to convert your BASIC programs into this powerful programming language....and write new programs with more depth, flexibility, and sophistication. Here's persuasive proof of why Pascal makes sense for most business and scientific applications, along with a wealth of data structures and program examples derived from real-world problems. You'll learn the similarities and differences between the two languages....and see the areas in which Pascal works better than BASIC.

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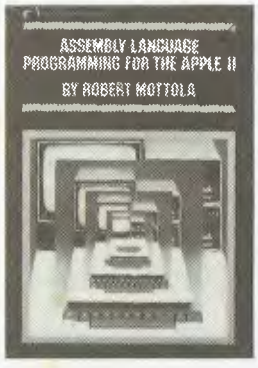

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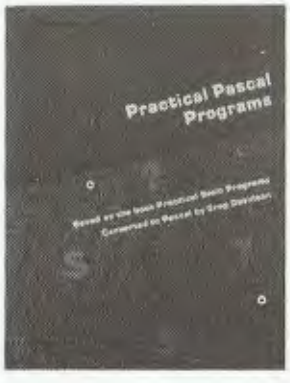
1982; $22.40



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by L. Poole & G. Davidson

This collection of programs written in UCSD Pascal is designed to conserve your valuable programming time. Although Pascal now is available on virtually every popular computer, the supply of such programs has not kept up with demand. While numerous practical Pascal programs have been written, they are not enough. Those that do exist are hard to find. To fill the gap, this book brings together 40 short programs that have already proven their usefulness in BASIC languages.

These programs are ready to use - key in the listing supplied, compile the program, and run. Programmed by Greg Davidson, a member of the original UCSD Pascal team, these programs have primary applications in the areas of finance, science and maths, management, decision and statistics.

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by A. Osborne & D. Bunnell

The newly revised third edition of Volume O - The Beginner's Book, provides the novice with an overview of microcomputers: how they function and what they can do for today's data management problems. The text clearly describes the components and functions of a micro system and introduces the reader to the basics of programming languages, the binary code, logic, timing and memory. New sections on software and communication have been added. As the first book in the popular Osborne/McGraw-Hill series, An Introduction to Microcomputers, The Beginner's Book provides the initial concepts needed for a thorough understanding of microcomputers.

1982; 233pp; $11.15

MICROCOMPUTER DATA COMMUNICATION SYSTEMS

by Frank J. Derfler

Here is a valuable guide for the beginning to advanced microcomputer user. In addition to technical detail, this book reveals social impacts of developing systems, along with sections for the handicapped and future use. Subjects include: practical hardware and software descriptions for TRS-80, Apple II, and Heath H-89; modems; terminals; electronic bulletin board systems; deaf communication systems; information utilities such as CompuServe and Source; and much more.

1982; 129pp; $19.25

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control the special hardware features, such as the hi-res graphics, the music, the cassette drive and the 'soft' keys. No 'structured' extensions, such as ELSE or DO. . .WHILE, are supported. Full screen editing is provided and AUTO line numbering but not RENUMber or DELETE (the latter facility mysteriously enough is included in the Double Precision version). Syntax checking is only performed after RUN and the error messages, although copious (there are 44 of them) are annoyingly of the form 'Error 53 in line 40' which necessitates keeping the look-up chart at your elbow. To be fair though, the descriptions on the chart are usefully detailed. No HELP is given by cursor position during debugging but the cursor controls will go into quickstep when depressed after SHIFT, which speeds editing considerably.

Variable names may be any length, although only the first two characters are significant; surprisingly, integer variables are not supported.

String variables are 255 chars maximum and in addition to the usual string functions there are CHARACTER $(x,y) which returns a character from that screen position, STRING $(x$,n) which gives n repetitions of the first character of x$, and SPACE $x, which gives a string of x spaces. Arrays of one or two dimensions only are permitted and scientific users will, alas, find no matrix-handling functions.

The precision of the arithmetic is 8-digit over the range 10E-19 to 10E19 with error trapping of overflow and underflow.

Both sequential and random access files are supported by the WOPEN and XOPEN statements; sequential files must not exceed 64k and the maximum number of files on a disk is 64, up to ten of which may be simultaneously open. The other file control statements include LOCK, UNLOCK, RENAME, IF EOF THEN, KILL, CHAIN and SWAP; the latter is a handy way of calling in a Basic program file from disk as a subroutine to a running program in memory, which is saved while the SWAPped routine is running and then resumed. All variables are passed unharmed to and from the SWAP routine. Random access files have a fixed record length of 32 bytes, which made it impossible to run the *APC* disk Benchmarks in a meaningful way. Reading from and writing to files is a straightforward process using. INPUT# or PRINT# and a string or numeric variable; a buffer number follows the '#', defining which open file is referred to. Machine language files may be saved on disk through Basic only by first saving to tape and then invoking a machine code utility called CMT on the master disk, which transfers from tape to disk. Another such utility formats disks, taking one minute to do so. All in all, file handling is simple and effective, if not hypersophisticated.

The picture becomes a bit more exciting when we come to the special graphics control statements. Screen control in the character mode is achieved through CONSOLE statements which can reverse the whole screen, define a scrolling window and set the display to 80 or 40 columns. CURSORxy puts the cursor at any desired position on the screen and saves its coordinates in two system variables, CRSH and CRSV. Control of the hi-res graphics is at three levels, the lowest of which is addressing of a single dot on the 320 x 200 grid by SETx,y and RESETx,y which blacks the dot out again. The page of video RAM in which this occurs is chosen by the GRAPH statement which selects page 1 or 2 and sets it in input or output mode or clears it, eg, GRAPH 012 sets both areas in output mode.

The next level is that of vector graphics, using LINEx1, y1, x2, y2, x3, y3, . . .which connects the pairs of points specified in its parameters by lines; a whole polygon can be drawn with a single LINE statement. BLINE draws a black line, ie, it resets a line in the same fashion. The third level is that of user-defined pixels through PATTERN n,X$, which defines an 8 by n dot pattern. Each line of eight dots in the pattern is set to match the eight bits of the binary ASCII code for the corresponding character in string X$. This pattern can be displayed at any screen location by specifying POSITION x,y. Each graphics area has its own position pointer whose current coordinates are found in system variables POSH and POSV.POINT (x,y) is a function which flags whether or not x,y is set in either or both areas.

In combination, these various facilities amount to a very powerful and economical graphics package though you will probably find PATTERN rather mindbending to use at first. It seems a bit churlish in the circumstances to say that I would have liked shape table graphics as well; certainly these graphics will satisfy most scientific and technical users as well as providing neat screen formatting for business programs.

Printer control is acheived through PRINT/P,LIST/P and DIR/P, in addition to which COPY/P dumps the screen contents to the printer (see Figure 1) and IMAGE/P defines a shape in the same way as PATTERN, but horizontally and on the printer.

The remaining special statements include FAST and REW for the cassette drive, DEF KEY to program a user key and KLIST which lists the key assignments. Multiple statements can be put on one key and may be defined to execute immediately or merely be displayed.

The music feature is controlled by MUSIC, followed by string data, and although the square-wave tones produced are hardly suitable for serious computer music, I found the feature useful for writing little recognisable sequences as audible error messages; these tunes can be accessed by ON ERROR GOTO branches and allow you to relax with a drink while some lengthy procedure is being performed. When a bad sector crashes your program, a little snatch from Siegfried's 'Funeral Music' will summon your attention or the 'Eroica' announce successful completion.

The Monitor is entered by the MON command or by RESET. It provides the minimal facilities for listing blocks of hex, changing the contents of a location and jumping to a specified address as well as saving, verifying and loading hex files on tape. It has its own manual which includes a complete assembler source listings and Z80 mnemonics.

I've dwelt at length on Disk Basic 6510 because the cassette Basic, which comes free with the machine, is merely a subset of it, minus the file handling, and the Double Precision Basic is Disk Basic with 16-digit accuracy (10E-+76) minus the trig log and exponential operators and with DELETE and PRINT USING added. All three Basics are compatible where they overlap. The set of compromises adopted is rather curious since scientific users will require the maths functions and are thus condemned to single precision; business users will certainly need the double precision if they wish to count the cents as well as the dollars. All three Basics are fast (see Benchmarks), the single precision being as fast as any we've tested.

CP/M

An attraction of this machine for business and sci/tech users must be its ability to run the CP/M operating system. It's a full and well-conceived implementation with various tweaks to make use of the special hardware features of the '80B. Some of these are extra transient commands including BACKUP, a fast copy utility for files and system tracks, CMT which copies between disk and tape allowing all 80B file types and full recorder control, CONSOLE which imports these commands (see above) into CP/M, and COPY which dumps screen contents to the printer. The keyboard is configured with n-key rollover, auto repeat, SHIFT for caps and 60 user-defined keys (all

ABS	IMAGE/P	REM
ASC	INP	RENAME
ATN	INPUT	RESET
AUTO	INPUT#	RESTORE
BLINE	INPUT/T	RESUME
BOOT	INT	RETURN
CHAIN	KILL	REW
CHANGE	KLIST	RIGHT$
CHARACTER$	LEFT$	RND
CHR$	LEN	ROPEN#
CLOSE	LET	ROPEN/T
CLOSE#	LIMIT	RUN
CLOSE/T	LINE	SAVE
CLR	LIST	SAVE/T
CONSOLE	LIST/P	SET
CONT	LN	SGN
COPY/P	LOAD	SIN
COS	LOAD/T	SIZE
CSRH	LOCK	SPACE$
CSRV	LOG	SQR
CURSOR	MID$	STEP
DATA	MON	STOP
DEF FN	MUSIC	STR$
DEF KEY	NEW	STRING$
DELETE	NEXT	SWAP
DIM	ON	TAB
DIR	OUT	TAN
DIR/P	PAGE/P	TEMPO
END	PATTERN	THEN
ERL	PEEK	TI$
ERN	POINT	TO
ERROR	POKE	UNLOCK
EXP	POSH	USR
FAST	POSITION	VAL
FOR	POSV	VERIFY
GET	PRINT	WOPEN#
GOSUB	PRINT#	WOPEN/T
GOTO	PRINT/P	XOPEN#
GRAPH	PRINT/T	
IF	READ	

Table 1 reserved words of Disk Basic SB-6510

First time on Earth.

Sharp brings you the MZ80B. A machine that offers you functions previously associated with more powerful, more expensive computers, that gives you versatility to handle a huge range of software and hardware applications in scientific, business and personal use.

The MZ80B opens up a new world of graphic display potential, more flexible data storage and retrieval, and ease of operation.

Here is the computer from the future. Available today.

Stunning Graphic Display

Seeing is believing. The large-screen high-focus, green-face display incorporated in the MZ80B gives you high resolution graphics of 320 x 200 dots.

An additional graphic RAM can be added which allows another 320 x 200 dot resolution pattern to be displayed.

This dual high-resolution graphic ability is especially useful for stimulating and displaying a dynamic picture. It can display 40 characters x 25 lines or 80 characters x 25 lines via software switching.

In addition there are facilities for full, on-screen editing, reverse video, partial scrolling and a full range of graphic symbols.

Character and Graphic Printer

This fast, quiet printer will reproduce your graphic displays and, of course, print-out upper and lower case letters and symbols. A tractor/friction feed version is also available.

Data Storage/retrieval

The MZ80B has a remarkable memory. 64K of RAM. And that constitutes all the memory area, giving flexible storage of any computer language and its software.

The cassette deck is electromagnetically-controlled, with a data transfer speed of 1800 bits/sec. combined with a unique programme search facility to make data storage and retrieval super-fast.

Software

Software includes Basic compiler, PASCAL, COBOL, FORTRAN and numerous accounting applications.

Floppy Disk Drive

A twin Floppy Disk Drive unit can be added which will give you 560K bytes of storage on double-sided, double-density disks.

Comprehensive Documentation

Each MZ80B comes complete with a full set of documentation including an owners' manual giving full circuit diagrams, a monitor reference manual and programming manuals.

Interfaces

RS232C and IEEE Interfaces are available allowing the MZ80B to communicate with scientific instruments and other peripherals.

CP/M* 2·2

CP/M* is also available making a wide range of packages immediately available including wordprocessing, financial modelling, data base management to mention but a few. CP/M* also increases the disk capacity to 680K bytes.

(CP/M* is a Trade Mark of Digital Research Ltd.)

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BENCHTEST
COMPUTER SYSTEM

the printer. The keyboard is configured with n-key rollover, auto repeat, SHIFT for caps and 60 user-defined keys (all the soft, cursor, tape and numeric pad keys, plus their shifts). On boot-up, these default to CP/M commands plus emulation of a Lear-Siegler ADM3A terminal; reprogramming is possible to emulate the control codes of Super-Brain, the MZ-80B itself and other terminals to facilitate software transfer. I was supplied with Wordstar, which made full use of these keys and on which this review was written. The hi-res graphics and music (except for BELL) are not directly available under CP/M but I am told there is a suite of subroutines called EXPAND which allow access to both, and the cassette recorder through Microsoft Basic or any other language under CP/M which uses the Microsoft Calling sequence.

FDOS and Pascal

Sharp's own FDOS operating system includes a Z80 assembler, linker, editor, symbolic debugger and PROM formatter and is quite 'CP/M-like' in its command structure.

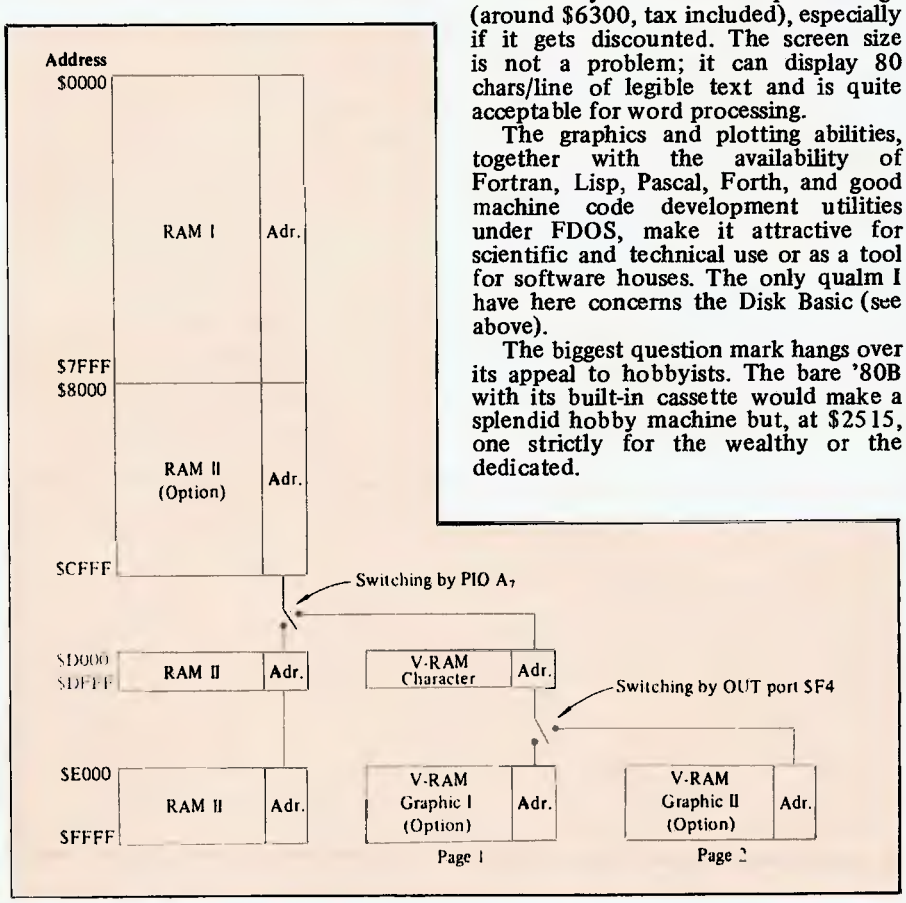
Sharp Pascal has the almost unique distinction of being interpreted rather than compiled and comes on tape together with its own monitor. Not being a qualified Pascal nut, I merely entered a couple of programs from *'Pascal Programs for Scientists and Engineers'* and perused the manual. It is a fully interactive interpreter with screen-oriented editing, as in Basic, combined with line editing to insert and delete since line numbers are provided automatically and consecutively. The interpreter performs a certain amount of formatting, such as converting reserved words to lower-case and adding '0' to integer reals, then syntax-checking is performed on entering G FOR GO. The reward, for a novice such as myself, is usually a rich crop of syntax errors. The main limitations of this Pascal seem to be that it can only handle tape, not disk files, that procedure declarations may not be tested, parameters are passed only by value, and no data structures more complex than an array are allowed in. On the plus side, it includes all the graphic and music control statements from Sharp Basic as well as colour control statements for a future colour enhancement, which the Basic doesn't have. The user keys come up with Pascal reserved words which goes some way toward mitigating the verbosity of the language. It would seem to be handy for learning Pascal if not for serious applications; hopefully, a Disk Pascal will emerge in due course.

Potential

Sharp's claim that the MZ-80B is a 'general purpose personal computer' is not without justification. Running CP/M, the full system compares favourably with currently popular small business systems in its price range (around $6300, tax included), especially if it gets discounted. The screen size is not a problem; it can display 80 chars/line of legible text and is quite acceptable for word processing.

The graphics and plotting abilities, together with the availability of Fortran, Lisp, Pascal, Forth, and good machine code development utilities under FDOS, make it attractive for scientific and technical use or as a tool for software houses. The only qualm I have here concerns the Disk Basic (see above).

The biggest question mark hangs over its appeal to hobbyists. The bare '80B with its built-in cassette would make a splendid hobby machine but, at $2515, one strictly for the wealthy or the dedicated.



Docmentation

The MZ-80B came with a whole bookshelf full of manuals, a user and a service manual for each hardware item and one for each language. Sharp ran into some flak for the 'kiddies guide to computing' approach taken in the MZ-80K manual and has veered to the other extreme for the '80B Owner's Manual. After 20 pages of basic introduction to the keyboard and operations, it launches into 100-plus pages of detailed hardware discussions including the memory management, PIO control codes and processor architecture, all of which will delight the experienced and terrify the first-time user. The various Basic language manuals consist of very full definitions of the reserved words (with examples) and little more; they inevitably overlap considerably. An experienced Basic user will find them quite adequate for reference. The Pascal manual is rather more ambitious and includes a readable and well-structured beginner's course in Pascal, while the FDOS manual is a massive loose-leaf binder containing an excellent and detailed account of all the facilities plus a detailed description of assembler programming with all relevant listings. All manuals are well produced on good paper though the standard of translation varies from manual to manual and occasionally sinks to the obscure. The upshot is that none of the manuals save the Pascal will be of much use to the total novice, but they contain all the information that an experienced user will need to exploit the system.

Expandability

The standard spec for the '80B in Australia comes with the 64k RAM, one of the graphics RAMs and tape Basic. The system can be further expanded using RS232, Centronics and IEEE ports so that daisywheel printers, plotters and other instruments can be hooked up. Sharp itself has a friction/tractor version of the tested printer, designated P6. Sharp has planned a hard disk controller and a colour card for use with a separate monitor.

Conclusions

There is nothing in the spec of the MZ-80B which breaks new ground as we enter the era of the 16-bit processor; rather, it's a refined example of well-established concepts, a Volvo among micros. It's a versatile and likeable machine which shows evidence of much thought in its design, particularly in the era of user conveniences. It could be equally happy as a high class home computer, a useful small business system or a laboratory instrument. After-sales service should be above average, given that Sharp has an Australian operation. It is already supported by more software than most machines have on launch and more will follow from independent houses as well as the manufacturer. It remains to be

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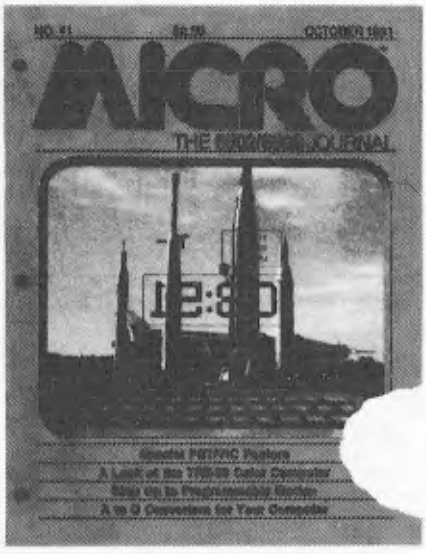

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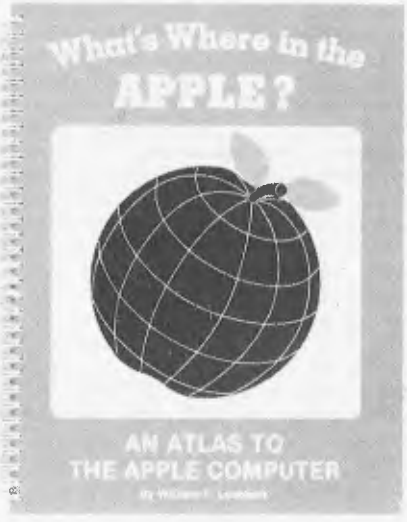

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SHARP MZ80B

seen how many high level languages will be available which can utilise its excellent graphics potential. Sharp has done most of it right with this product and I wish it well.

Prices

MZ-80B (inc tape Basic and manuals)	$2515.00
Expansion port	145.00
Graphics RAM 2	included
Printer (inc interface card and cable)	1199.00
Disk Basic	75.00
Hardware system as tested	6300.00

Benchmarks:

(Timing in seconds)

	Single Precision Basic	Double Precision Basic
BMI	0.6	0.7
BM2	4.5	5.0
BM3	8.5	12.0
BM4	11.5	19.0
BM5	13.0	20.0
BM6	19.0	27.5
BM7	27.5	38.0
BM8	5.0	—

Technical specifications

CPU:	Sharp LH0080A (Z80A) 4 MHz.
Memory:	64k dynamic RAM, 10k Video RAM (expandable to 18k), IPL in 2k ROM, character generator in 2k ROM
Keyboard:	92 keys inc numeric, function, cursor and cassette controls, ASCII standard typewriter main keyboard.
VDU:	9in diagonal, green-on-black CRT, 25 lines x 40 or 80 chars, 320x200 dots in graphics mode.
Cassette:	Audio cassette tape, 1800 bits/sec, fast search facility, all functions programmable.
Disk drives:	Sharp MZ-80FD twin double density double-sided 5in 280k per drive, 560k per unit, up to 2 units (4 drives)
Printer:	Sharp MZ-80P5 9x8 dot matrix, 80cps. 40, 68, 80 or 136 chars/line.
Ports:	Optional RS232C, IEEE-488, Sharp Universal I/O
System software:	Optional CP/M, Sharp FDOS
Languages:	Basic, Basic Compiler, Pascal.

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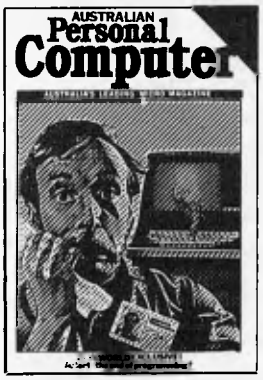

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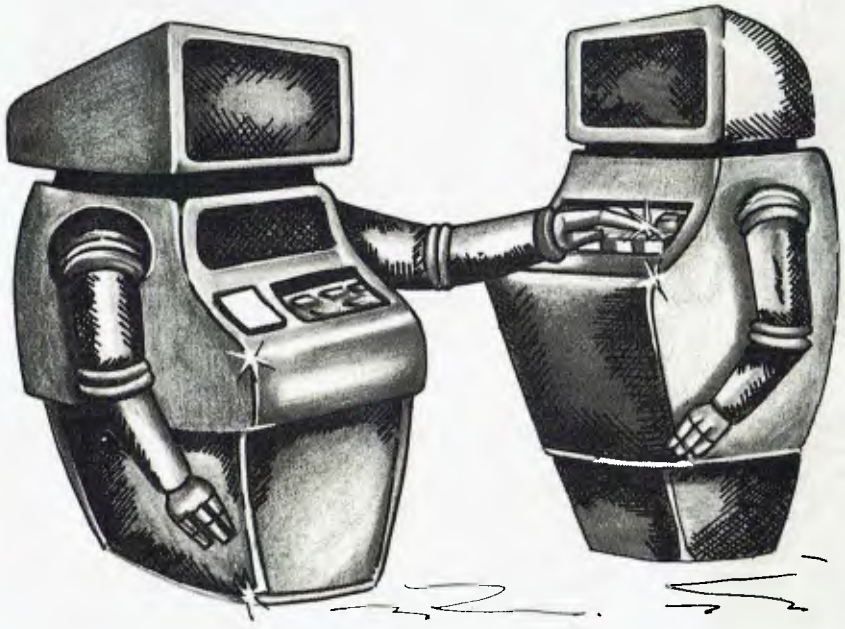


Part IX

CHARACTER CODES

by Hewlett-Packard's Steve Leibson

Language is quite possibly the most powerful component of civilisation. Humans could not purposefully organise without shared language. Furthermore, the roots of all major human languages are verbal rather than visual.

Speech, our verbal use of language, would not be possible without the evolutionary heritage humans share that has produced our marvelously complex vocal tract, with lips, teeth, tongue, larynx and other organs we need to produce sound which others may understand. But the hardware of speech is not sufficient for shared understanding – a common language is also required.

COMPUTER'S ALPHABET

This series has been discussing the hardware components with which computers are built, allowing them to communicate with other machines. It is now time to discuss the languages computers use to communicate with other machines, rather than the equipment they use to do it.

WANTED: STANDARD CODE

As covered previously, digital computers use a binary language for their internal communication. There are several methods for representing data internally in a computer, however, and it would be advantageous if there were some standard language that computers could use for communicating with other equipment.

In addition, it is important that such a language be compatible with human communications, since some of the devices that the computer will be communicating with are intended to interact with people. Printers and CRT terminals are examples of this type of equipment.

HISTORY OF CODES

The problem of creating a code, or computer language, that corresponds to an alphabet existed prior to the advent of computers. Even before electricity was harnessed for communications, man-made devices such as flags and semaphores were used to send messages.

Samuel Morse perfected the first code for electric data transmission, the Morse code. This set of dots and dashes is capable of representing the English alphabet and Arabic numerals so that intelligible messages may be interchanged between remote stations.

Early in this century, interest developed in replacing human telegraph operators with machines. Morse code was too difficult to mechanically decode, due to it's variable length per character.

But the idea of standardised code was retained. The dots and dashes evolved into the concept of bits. Each bit could either be a "1" or "0", represented by either the presence or absence of an electrical signal.

The first code to use bits for machine communications used five bits to encode the alphabet. Five bits allowed 32 characters to be represented. Since the English alphabet has 26 characters, and at least ten numerals also need to be represented, it seemed that there would be a problem. There were not enough codes to go around.

SHIFT CODES

The problem was solved by having two special codes that did not represent characters. Instead, these codes were shift codes. One code, called Letters, caused all following codes to be interpreted as letters of the alphabet. The other code, called Figures, caused all following codes to be interpreted as numerals and punctuation marks.

Such special codes were called shift codes because they shifted between different character sets. There were two five-bit codes that were in wide use, called Baudot and Murray.

These codes were very similar in concept, but varied in some assignments of codes to characters. The existence of two competing codes led naturally to the first I/O incompatibility problems.

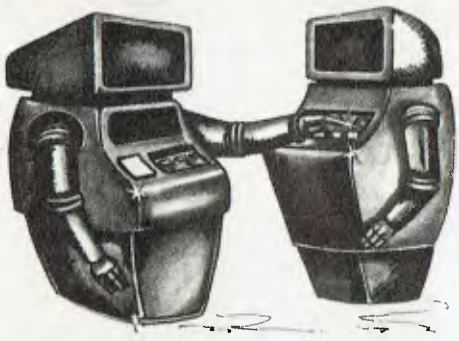
A FLAW

Character codes that relied on shift characters for proper operation were troublesome, because the interpretation of the incoming codes relied on the previous history of the message. Unless the receiving device knew which character set to use, there was a 50% chance of erroneous decoding.

Clearly, five bits were not enough. A code that could represent all the printable characters, and which did not rely on previous transmissions for unambiguous decoding, was needed. In addition, some sort of expandability was desired to prevent another dead end system.

MODERN CODES

By the time the need for this new code was felt, and the technology which could handle more complex codes became feasible, many manufacturers were involved in constructing electronic equipment which might also use the code. Whenever the need arose for such



Just as differences in language can create communication problems for humans, character code incompatibility can render an otherwise operable interface useless.

standardisation, there were two methods of satisfying it.

A single manufacturer could simply go out and invent a solution and expect the rest of the industry to follow. This was the route taken by IBM, which invented the EBCDIC (Extended Binary Coded Decimal Interchange Code) character code. EBCDIC is an eight-bit code allowing 256 characters to be represented. Since there aren't that many printable characters, there are some unused codes in EBCDIC.

ASCII

The other method of obtaining a standard was through compromise in a committee. Other manufacturers did meet in order to develop a national standard called ASCII (American Standard Code for Information Interchange).

ASCII is a seven-bit code allowing 128 characters to be represented. This includes the alphabet, both upper and lower case, the numerals 0 through 9 and punctuation marks such as the period and the question mark.

In addition, several codes exist to control the operation of the device receiving the message. Codes representing Carriage Return and Line Feed are evident to anyone who uses a typewriter. Other control codes include Form Feed, Bell and Horizontal and Vertical Tabs. These codes are clearly for control of various printing devices, although manufacturers of some products have used these codes for other machine dependent actions.

Finally, there are codes used to control how the receiving device will interpret subsequent data. There are two shift characters, called Shift In and Shift Out, used to switch between character sets (English letters aren't the only kind, you know). There are also control codes that delimit text. STX (Start of Text) and ETX (End of Text).

ASCII has been a very successful character code. Thousands of instruments and computer-related products use this code for I/O. Even IBM now offers equipment that uses ASCII. Several interfaces have been covered in this series, and all except the BCD interface may be used to transmit and receive ASCII code.

PLANNING THE ESCAPE

The planners of ASCII tried to foresee as many different applications as possible. That is the reason for including the various control codes. They recognised that technology's advance could not be totally predicted and therefore gave themselves an escape clause.

One of the ASCII characters is called the "escape" character. This character designates that the characters following have a special meaning.

The intent in creating the escape sequence was to extend the range of the character sets by selecting from a range of available sets. Graphics, nationalised character sets, and special application sets have been developed for selection with certain escape sequences. Escape character sequences allow for a much richer variety of characters than the simple shift in/shift out scheme of the five-bit codes.

The now common CRT terminal has provided the escape sequence its widest application, however. The inclusion of microprocessors in terminal design has greatly augmented CRT capabilities. The serial communications link to these terminals has not been changed in years. One data channel to the host computer is all that is available.

Ordinarily, any characters that are received via this channel are printed on the terminal screen. But capability for character and line deletion, display enhancements such as inverse video and underlining, and even control of tape drives in the terminal does not exist in ASCII standard. The escape sequence allows for these new capabilities.

CREATIVITY

Manufacturers of CRT terminals are now adding increased performance to their products via excape sequences. Unfortunately, since the actual effect

b7 b6 b5 / Bits / b4 b3 b2 b1 / ROW \ COLUMN	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

Mnemonic and Meaning[1]		*Mnemonic and Meaning*[1]	
NUL	Null	DLE	Data Link Escape (CC)
SOH	Start of Heading (CC)	DC1	Device Control 1
STX	Start of Text (CC)	DC2	Device Control 2
ETX	End of Text (CC)	DC3	Device Control 3
EOT	End of Transmission (CC)	DC4	Device Control 4
ENQ	Enquiry (CC)	NAK	Negative Acknowledge (CC)
ACK	Acknowledge (CC)	SYN	Synchronous Idle (CC)
BEL	Bell	ETB	End of Transmission Block (CC)
BS	Backspace (FE)	CAN	Cancel
HT	Horizontal Tabulation (FE)	EM	End of Medium
LF	Line Feed (FE)	SUB	Substitute
VT	Vertical Tabulation (FE)	ESC	Escape
FF	Form Feed (FE)	FS	File Separator (IS)
CR	Carriage Return (FE)	GS	Group Separator (IS)
SO	Shift Out	RS	Record Separator (IS)
SI	Shift In	US	Unit Separator (IS)
		DEL	Delete

In this table of ASCII characters, the most significant three bits are shown at the head of each column, in both binary and hexidecimal. The least significant four bits are shown for each row. To determine the ASCII code for an upper case H, use the most significant three bits of column four, 100; and the least significant four bits from row eight, 1000; to form the binary code 1001000. Columns 0 and 1 are non-printing control characters. The rest are printable except for the last character, DEL, which is the delete character.

of these sequences is not covered in the ASCII standard, the terminal designers have felt free to create their own standards.

For example, one major feature now found on most CRT terminals is cursor positioning. The ability to place a cursor anywhere on the screen directly is important for many types of form-filling applications. There are about as many escape sequences for performing this task as there are CRT terminal manufacturers.

They all work similarly. The host computer sends the terminal an escape character. This is followed by a second character indicating that the escape sequence is for cursor positioning. Two more characters follow, giving the X and Y positions for the cursor. Usually the sequence is self-terminating, meaning that four characters including the escape are all that the computer need send.

After receipt of the fourth character, the terminal performs the action requested and prints any further characters received. Note that the ASCII characters in the escape code sequence are not interpreted as printing characters, but as control characters. The escape character has the effect of temporarily converting all ASCII characters to control.

CODE CONVERSION

The majority of computer equipment uses ASCII character representation today. Unfortunately, some of the older equipment still in use may not.

Interfacing to these devices requires that the ASCII characters the computer would like to send must be converted to characters that the peripheral would like to receive. Here we are assuming the hardware interfacing requirements have already been met.

In addition, some modern peripherals may have odd requirements that can be met only through code conversion. An example is a printer that automatically inserts line feeds whenever it receives a carriage return. Unless the application calls for double spacing, the printout won't be as desired, since many computers send both carriage return and line feed to denote the end of a line of text.

One solution to this problem is to have the computer convert all line feeds to non-printing characters, such as "nulls". Most peripheral devices ignore the null character, which is the ASCII zero.

Character codes are yet another source of incompatability in the world of I/O. Just as differences in language can create communication problems in humans, character code incompatability can render an otherwise operable interface useless.

Fortunately, if the computer has a language that is rich in I/O capability, even this language barrier can be overcome.

Steve Leibson joined the Calculator Products Division (now the Desktop Computer Division) of HP in June, 1975. Since then he has worked on a variety of hardware and software products, all relating to interfacing of desktop computers. His products include the 9878A I/O Expander, the 98036A Serial Interface, the 98224A Systems Programming ROM for the 9825A and the I/O backplane for the System 45.

In 1980 Steve co-authored a book: *The Great Small Business Computer Ripoff* with a close friend, Bill Scott. He has published the book himself by forming a small company called Data Press.

Steve now works for the Auto Trol Technology Corporation of Denver, Colorado.

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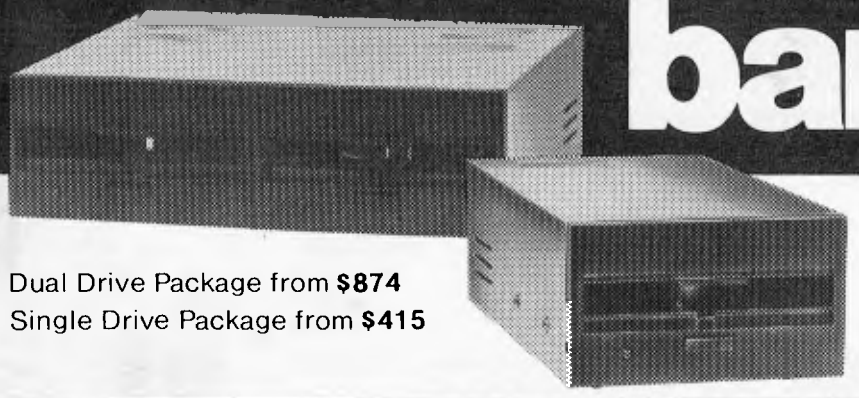

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Continued from page 43

that is MODE 2. The screen has 72 by 65 cells in this mode. Each line of cells is represented by 24 bytes made up of two control bytes, two bytes for a left margin which cannot be plotted, 18 bytes for the 72 cells, and two more bytes for the right margin. Moving left to right across the screen, these bytes are in descending order in store. The upper control byte for the top line is always at store location # BFEF, so the top left of the plottable screen is stored in #BFEB. the top right (71, 64) at #BFEB-17, and the bottom left (10, 0) at #BFEB-64*24.

Each block of eight cells is represented by two bytes, two bits per cell. The top bit in each byte determine together the leftmost cell in the block, and so on down the two bytes. The value of the two bits together give which of the four possible colours is to be used — how these four colours are chosen from the total of 16 is set in the control bytes for the line.

Program G1 copies an area of 32 by 20 cells from the bottom left of the screen to the bottom right, and reverses it. SCRN reads the colour of the cell at the stated coordinates. This method is slow because each call to SCRN causes two bytes to be fetched from store and the appropriate bit unpacked from each of them, while DOT entails setting a bit in each of two bytes. It does not use the array A.

Program G2 using the reversing array A runs about four times faster. There is no packing and unpacking of bits to do. The bits in each byte are reversed and pairs of bytes along a line are reversed in order so that bytes a b c d e f g h become g h e f c d a b. Once again the price of speed is a more complicated program. This can easily be adapted to work in other modes — higher resolution and 16 colours. I have chosen the simple case where the edges of the areas to be copied to and from, line up with the blocks of eight cells corresponding to a pair of bytes. Clearly if the edges pass through the middle of a block of eight, there will have to be some packing and unpacking, but this will be once or twice for each byte rather than for every bit, and the program will still be two or three times faster than the method using SCRN and DOT.

Fig 1

Fig 2

PATTERNS

```
200 MODE 2
210 COLORG 0 1 2 3
220 FOR I=0 TO 19
230 FOR J=0 TO 31
240 DOT 71-J,I SCRN(J,I)
250 NEXT J
260 NEXT I
```

Program G1

```
200 MODE 2
210 COLORG 0 1 2 3
220 B=  BFEB-64*24
230 FOR I=0 TO 19
240 FOR J=0 TO 7 STEP 2
250 POKE B+J-16,A(PEEK(B-J))
260 POKE B+J-17,A(PEEK(B-J-1))
270 NEXT J
280 B=B+24
290 NEXT I
```

Program G2

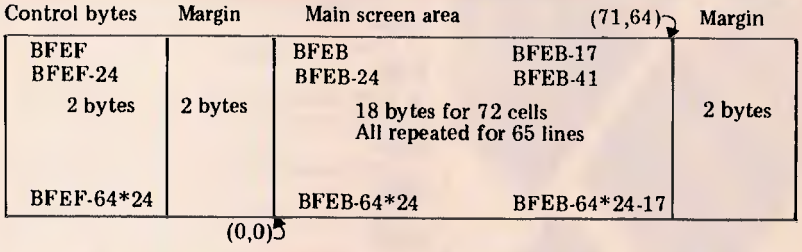

Figure 3 — Screen Map for MODE 2.

Next month, if I keep to my plans, I shall show some patterns based on a simple program to generate octagons — and write about deciding in 3-D graphics which lines and planes are behind which others — the famous hidden surface problem.

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TJ's WORKSHOP

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PET COMPUTED RESTORE

Listed below is a routine which allows the user to perform RESTORE to a line number. After running the appropriate Basic loader program for new or old ROMs (Basic 4 and VIC owners will have to make their own alterations), SYS RE, X will RESTORE to line X. The next time DATA is required the Basic interpreter will start searching from line X as if nothing had happened.

This function can be useful in reading information from a table of DATA statements too large to be copied into an array. Considerable memory space is saved with only a slight loss in speed.

The following example uses the routine to get close to the required item, then READs consecutive items until the right one is reached. To READ the Nth string into D$ from the program's own DATA use:
SYSRE, 100 + 10 * INT(N/8): FOR X = 0TO N AND 7: READ D$: NEXT

Remember to check that N lies within 0-29 and that RE – 1031. Note that the INT (N/8) and N AND 7 bits refer to the number of items on a DATA line, ie, 8.

The routine is POKE0 into the REM statement on line 0, so once the program has been run only lines 0 and 10 are required. Alternatively the routine can be located elsewhere by changing the value of RE, although I find that having the code in a REM statement is more convenient.

An 'ILLEGALQUANTITY ERROR' will occur if the line number is not in the range 0 - 65535 and an 'UNDEF'D STATEMENT ERROR' if the line does not exist. The latter of these may be disabled by changing the JMP instruction to BIT (line 110 – replace 4C with 2C), causing RESTORE to the line following.

David McKeran

COMPUTED RESTORE

```
0 REM"RESERVED FOR MACHINE CODE....."
10 RE=1031
100 DATA 20,F8,CD,20,8B,CC,20,D2
110 DATA D6,20,2C,C5,B0,03,4C,EB
120 DATA C7,A4,5D,A6,5C,D0,01,88
130 DATA CA,86,3E,84,3F,60
200 FORX=0TO29:READ D$:DD$=MID$(D$,2)
210 POKE RE+X,16*(ASC(D$)-9*(D$)=
 "A")AND15)+(ASC(DD$)-9*(DD$)="A")AND15)
220 NEXT
READY.
```

OLD ROM DATA

```
100 DATA 20,11,CE,20,A4,CC,20,D0
110 DATA D6,20,22,C5,B0,03,4C,DB
120 DATA C7,A4,AF,A6,AE,D0,01,88
130 DATA CA,86,90,84,91,60
READY.
```

APPLESOFT FORMATTER

In many programming applications it is important to produce nice-looking tables which can be used and understood with pleasure. To make this task easier some dialects Basic and most of the more sophisticated languages have formatters built into them which handle the presentation of numeric output. Unfortunately, Applesoft has no such feature and it is the purpose of this note to offer a flexible formatting subroutine for use in Applesoft programmes.

The subroutine is listed in Fig 1 where it will be seen that, despite its simplicity, it has the following powerful features:

All rounding is correct and symmetric for both positive and negative numbers.

Numbers are presented right justified in a field of specified width. Furthermore they are located so that when printed in columns they line up correctly.

Decimal points are suppressed in whole numbers.

Zeros are replaced by blank space or, if preferred, by a specified string.

Numbers which are too large for the field width are replaced by a specified string and do not throw adjacent fields out of alignment.

A prefix or suffix can easily be added to numbers.

Negative numbers need not be denoted by a minus sign but could use, eg, brackets.

Commas are inserted between thousands in large numbers.

The symbol used to denote the decimal point or to separate thousands can easily be changed.

An example program, listed in Fig 2, shows how simple it is to use the subroutine in a program.

The most obvious improvement is to shift lines 10010-10040 to the calling program. This will ensure that they are only repeated when absolutely necessary and not every single time the subroutine is called. Furthermore, since the calculation of DD would be particularly slow it may be worth taking some extra trouble with this to gain more speed. One possible approach would be to set up an array D with D(I)=INT (10/\I+.5) and subsequently to use DD=D(D) instead of the actual calculation.

A couple of further speed improvements are possible because of specific characteristics of Applesoft. The first of these is to replace all the integer constants by variables of equivalent value because, surprisingly enough, evaluating (L1+1) would be slower than evaluating (L1+Z). The second improvement would be to renumber the subroutine so that it resides as early in the program as possible.

If speed continues to be a problem after these steps have been taken it is possible to gain a little more by deleting line 10090. Commas would, of course, no longer be inserted but otherwise there would be no effect on the operation of the program.

The only significant shortcoming of the formatter is its inability to handle more than nine significant figures. The reason for this is that beyond nine figures the Applesoft function STR$ returns the number in exponent form. However, if that would be acceptable in a particular application the subroutine may be appropriately modified by replacing the right hand side of 10050 by X$=STR$(X):L1=LEN(X$): GOTO 10120.

Michael J Barron

```
10000  REM   ***SUBROUTINE*** FORMAT
Requires   X (real number) ; FW (field width) ; D (decimal places)
Returns    X$ (formatted number)

10010 DD =  INT (10 ^ D + .5): REM  Calculate scale factor
10020 S$ = "                    ": REM  Enough spaces to accomodate the widest field width
10030 SS$ =  RIGHT$ (S$,FW): REM   Set string for X$ when X is zero
10040 SN$ =  RIGHT$ (S$ + "N/A",FW): REM   String for X$ when X is too large for the field width
10050 XX =  ABS (X) * DD: IF XX > 999999999 THEN X$ = SN$: RETURN
10060  IF XX < .5 THEN X$ = SS$: RETURN
10070 X$ =  STR$ ( INT (XX + .5)): IF XX < DD THEN X$ =  RIGHT$ ("000000" + X$,D + 1)
10080 L1 =  LEN (X$):L2 = D + 3
10090  IF L1 > L2 THEN X$ =  LEFT$ (X$,L1 - L2) + "," +  RIGHT$ (X$,L2):L1 = L1 + 1:L2 = L2 + 4: GOTO 10090
10100  IF D > 0 THEN X$ =  LEFT$ (X$,L1 - D) + "." +  RIGHT$ (X$,D):L1 = L1 + 1
10110  IF X < 0 THEN X$ = "-" + X$:L1 = L1 + 1
10120  IF L1 > FW THEN X$ = SN$: RETURN
10130 X$ =  RIGHT$ (S$ + X$,FW)
10140  RETURN
```

Fig 1

```
10  REM  PROGRAM TO ILLUSTRATE FORMAT
20 FW = 10:D = 2: REM   Set FW (field width) and D (decimal places)
30 BUFFER$ = "": REM   Empty the buffer
40  FOR I = 1 TO 4: INPUT "NUMBER ? ";X: GOSUB 10000:BUFFER$ = BUFFER$ + X$: NEXT
50  PRINT : PRINT BUFFER$
60  GOTO 30
70  END
```

Fig 2

TJ's WORKSHOP

ZX81 MEMORY MANAGEMENT

This subroutine was designed for use with the ZX81 plus 16K expansion board, to show how much memory has been used by a main program for each of the four main RAM areas — 'Program', 'Display', 'Variables' and 'Spare capacity'. The start and finish addresses are also printed under each subheading, and the memory utilisation is printed at the bottom of the screen as a percentage of the total available.

String variables A$ and B$, suitably sliced and added to 16000, generate the PEEK addresses of the RAM boundaries. E$ is an array containing subheadings. The loop 9610 to 9700 carries out all functions except for printing the percentage utilisation, which is undertaken by 9710. Statements 9650, 9730 and 9740 generate the first RAM address which is not available as a PEEK function. The first three characters in B$ are dummies.

The subroutine could be extended to give information about the GOSUB stack, etc, by adding additional addresses into A$ and B$, enlarging E$ to include additional subheadings, and increasing the number in the FOR-NEXT statement, but the format would have to be reorganised to prevent screen overflow. Remember also that the subroutine detracts from the total usable memory available for the main program, so don't overdo it!

If the subroutine is loaded from tape before keying in the main program, it will be SAVEd again whenever the main program is saved and will therefore always be available to keep tabs on the memory situation. When the bottom line says 'MEMORY UTILISATION = 98%' — don't panic. Just erase the subroutine and release a few more bytes.

Any machine code subroutines used in the main program after RAMTOP should not affect the accuracy of the 'Memory status' statement, but any bytes POKEd between STKEND and ERR SP will reduce the spare capacity available without being detected by the subroutine. The machine stack will usually also occupy a few bytes in this area. No attempt has been made to quantify these sources of error because they are normally relatively small, but purists may wish to take the matter further themselves.

The choice of names of the string variables used in the listing was made to avoid ambiguity with those in a specific main program; others may be more suitable for readers' applications.

It might be possible to use the subroutine on a 1k memory provided the centre parentheses of 9710 were changed to 1 — (JA-JB)/1024 and some of the frills were removed. Statements 9500-9600 could be omitted for minimisation after the variables A$, B$ and E$ have been set up and SAVEd onto tape, provided the RUN button is avoided. Any advantage gained by using this routine on a 1k memory should be balanced against the amount of precious memory it uses up itself.

G E Coucher

```
9500 REM MEMORY MANAGEMENT
9510 LET A$ = "396400404386"
9520 LET B$ = "509396400412"
9530 DIM E$(4,10)
9540 LET E$(1) = "PROGRAM"
9550 LET E$(2) = "DISPLAY"
9560 LET E$(3) = "VARIABLES"
9570 LET E$(4) = "SPARE CAP"
9580 CLS
9590  PRINT TAB 9; "MEMORY STATUS"
9600 PRINT TAB 9; " . . . "
9610 FOR E=1 TO 4
9620  LET J1=VAL A$(3*E-2 TO 3*E) + 1600
9630  LET J2=VAL B$(3*E-2 TO 3*E) + 1600
9640  LET JA=PEEK J1+256*PEEK (J1+1) - 1
9650 IF E=1 THEN GOTO 9730
9660  LET JB=PEEK J2+256*PEEK (J2+1)
9670  PRINT AT 4*E, 0; E$(E); TAB 12; (JA-JB)/1000;"KBYTE"
9680 PRINT "STARTING ADDRESS"; TAB 26;JB
9690 PRINT "FINISHING ADDRESS"; TAB 26; JA
9700 NEXT E
9710  PRINT AT 21,3; "MEMORY UTILISATION=";
   INT (.005+(100*(1-(JA-JB)/16384))):"P.C."
9720 RETURN
9730 LET JB=16509
9740 GOTO 9670
```


STOP

(Read this now!)

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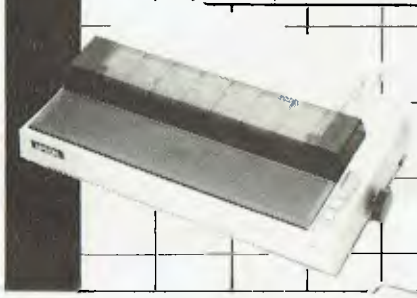

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VIC USER-DEFINED CHARACTERS

TJ's WORKSHOP

Byte map location 36869 (9005H)

7	6	5	4	3	2	1	0

Screen Start — Character Set Start

Fig 1

Value representation of lower four bits of location 36869 (9005H)

Bit	Value if set	Value if not set
0	1024 (0400H)	0 (0000H)
1	2048 (0800H)	0 (0000H)
2	4096 (1000H)	0 (0000H)
3	0 (0000H)	32768 (8000H)

eg,

BITS	VALUE
0110	6144 (1800H)
1101	37888 (9400H)

Fig 2

To find current character set start

```
CT = PEEK (36869) AND NOT 240
TS = (1 - INT ((CT AND NOT 7)/8) * 32768 + (CT
        AND NOT 8) * 1024
```

CT = Lower four bits of location 36869 (9005H)
TS = Address of current character character set

Fig 3

To set character set start

```
CT = ( - INT (TS/32768)) *8 + INT (TS - INT(TS
        /32768) * 32768)/1024
POKE 36869, PEEK (36869) AND NOT 15 OR CT
```

CT = Lower four bits of location 36869 (9005H)
TS = Address of current character set

Fig 4

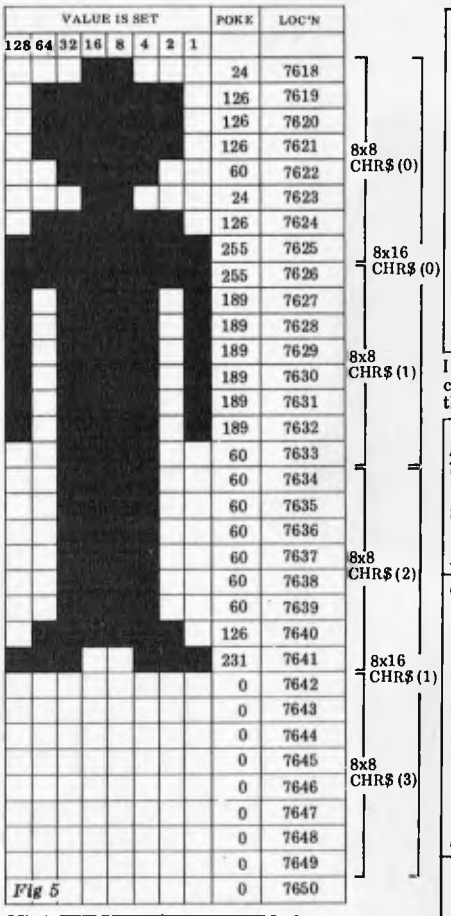

Fig 5

Example of programming the character set

```
10 POKE 56, 28, CLR
30 TS = 7168
40 CT = (1 — INT (TS/32768) * 8+INT (TS — INT (TS/
   32768) * 32768)/1024
50 POKE 36869, PEEK (36869) AND NOT 15 OR CT
60 FOR I = TS TO TS + 31: READ J: POKE I, J: NEXT
70 FOR I = 64 to 67: A$ = A$ + CHR$ (I) + CHR$ (17)
     + CHR$ (157): NEXT
80 FOR I = 1 to 4: A$ = A$ + CHR$ (145): NEXT: A$
   = A$ + CHR$ (29)
90 PRINT TAB (10); A$
100 DATA 24, 126, 126, 126, 60, 24, 126, 255, 255,
     189, 189, 189, 189, 189, 189, 60
110  DATA 60, 60, 60, 60, 60, 60, 126, 231, 0, 0,
      0, 0 , 0 , 0 , 0 , 0
```

Fig 6a

I have used A$ as a type of defined shape. It uses cursor commands to print one part of the man below another then the cursor is moved to the next printing position.

Changes to part a to use an 8 x 16 matrix

```
20 POKE 36867, 33: POKE 36865, 22
70 FOR I = 64 TO 65: A$ = A$+ CHR$ (I) +
   CHR$ (17) +  CHR$ (157): NEXT
80 FOR I = 1 TO 2:A$ = A$ + CHR$(145): NEXT: A$
   = A$ + CHR$ (29)
```

Fig 6b

Ordered plan of steps involved when programming the VIC character set.

1. Draw shapes on paper (see fig 5)
2. Work out POKE values (see fig 5)
3. Work out memory requirements and where to locate the shapes.
4. Write program;-
   a) reserve memory
   b) clear strings and variables
   c) if necessary change screen/character size
   d) set location 36869 (9005H) to character definition start (see figs 1, 2, 4)
   e) Read data lines containing POKE values and POKE into reserved memory.

Fig 7

Some CHR$s, PEEKs and POKEs

CHR$ (17) = Cursor down
CHR$ (29) = Cursor right
CHR$ (145) = Cursor up
CHR$ (157) = Cursor left
CHR$ (8) = Disable Commodore & SHIFT
CHR$ (9) = Enable Commodore & SHIFT
CHR$ (14) = Switch to lower case
CHR$ (142) = Switch to upper case
55-56 (37H - 38H) = Top of memory pointer
646 (286H) = Current colour code (try POKEing this to a value in the range of (8 - 15)
36869 (9005H) = Lower four bits are character set start

Fig 8

Start address	Description
32768 (8000H)	Upper case & Graphics (1k)
33792 (8400H)	Reversed upper case & reversed graphics (1k)
34816 (8800H)	Lower/upper case & graphics (1k)
35840 (8C00H)	Reversed upper/lower case & reversed graphics (1k)

From character set (4k) = 32768 - 36863 (8000H - 8FFFH)

Fig 9

In the adverts for the VIC you are told that it is possible to program the character set, but the manual does not tell you how to do this. Programing your own characters would, however, improve your games and animated displays drastically. Once you know how to do this you will have a lot of control over what comes on the VIC screen.

The characters on the VIC can be placed in either of two areas of memory. The starting addresses of these areas are: 0 — 7168 (0000H — 1C00H) inclusive (RAM); 32768 — 39936 (8000H — 9C00H) inclusive (ROM).

The start of the character set in ROM is 32768 (8000H). The address at which the character set starts must be a multiple of 1024. This means that the character set has a minimum movement of 1k (1024 bytes).

Location 36869 (9005H) contains the address of the start of the character set in the memory. This byte also contains some of the screen pointers (the start of the screen RAM if you want to know). When moving the character set we must not alter these. Fig 1 shows a plan of the byte. Fig 2 is a table of values representing the lower four bits which denotes the starting address of the character set.

Once I had worked out how this byte worked I wrote two small programs to find the character set start address and relocate the start of the character set to your own requirements. These programs are Figs 3 and 4 respectively.

You have a choice of an 8 x 8 character matrix or an 8 x 16 matrix when making your shapes. If you use 8 x 8 characters then you need not reset anything. If you require 8 x 16 characters then you should use the following line in your program to convert the VIC to 16 lines of 8 x 16 characters:

```
POKE 36867, 33:
POKE 36865, 22
```

You will notice that the size of the screen suddenly grows when you use this routine. The bottom line will be off the screen.

Once you have selected the size of character to use you must reserve yourself some memory in which to store your shapes. Memory locations 55 - 56 (37H - 38H) will contain this. The top of memory is usually set to 7680 (1E00H). If you moved the top of memory down to 7168 (1C00H) then you would have 512 (200H) reserved bytes (Note: 7168 is a multiple of 1024). This could give you 64 8 x 8 characters or 32 8 x 16 characters, because 8 x 8 characters take up 8 bytes and 8 x 16 characters take up 16 bytes. Use the following line to reserve this space:

```
POKE 56,28 : CLR.
```

If you reserve this space then you can start your character set at location 7168(1C00H).

To actually make your character I will explain with an example of a small man. You should set out a table for your characters like the one in Fig 5. To work out the POKE value you should add up the values of the bits where a point is to be plotted.

Once you have the POKE values worked out you should POKE them into your reserved memory. This is done by starting at the top of your list of POKE values and POKEing them one after the other into your reserved memory. The first value will be stored at the start of this memory and the second at the start +1 and so on. Fig 6a shows a program to store my small man using four 8 x 8 characters. Fig 6b shows the changes required to use two 8 x 16 characters.

Fig 7 is an ordered plan of the steps involved when creating a character set. The ordering of it is different to the ordering of my explanations because after setting the top of memory you must clear all strings and variables. If this step is done first then you will not lose any of the character set addresses.

Kevin Irving

APC SUBSET

by Ian Davies

Continuing last month's series of routines for assembly language enthusiasts, SUB-SET presents a selection of numeric utilities for a number of processors.

6502 32-BIT ARITHMETIC

This month's numeric special kicks off with a couple of routines for 32 bit manipulation on a 6502 based machine. The first routine, SNEG46, simply negates a 32 bit quantity. Not a spectacular operation in itself, but extensive use of this routine is made in the other numeric routines. The second routine is called SBAD46 and performs a 32 bit binary to ASCII decimal conversion.

These routines make use of the mnemonics M0 through to M4. These refer to a working storage area which may be assigned to any five contiguous bytes within page zero. This set of routines will continue next month with multiplication, division and ASCII to binary conversion.

Datasheet

```
;= SNEG46 — Negate 4 bytes
;/ CLASS: 2
;/ TIME CRITICAL?: No
;/ DESCRIPTION:   Negates (2's complement) 4 bytes in zero page
;/                with the Cy copying the sign of the result
;/ ACTION:        Byte count ← 4
;/                Byte pointer ← 0
;/                Cy ← 1
;/                Loop until byte count zero
;/                Byte ← 0 — byte — Cy
;/                Byte pointer ← byte pointer + 1
;/                Byte counter ← byte counter — 1
;/                Loop end
;/                Cy ← sign of result
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:         Locations M1 — M4 contain a signed 32-bit number with
;/                the most significant byte in M4 and the least
;/                significant in M1
;/ OUTPUT:        Locations M1 — M4 are negated and the carry is set
;/                to the resultant sign
;/ REGs USED: A,X,P,M1 to M4 and ME
;/ STACK USE: None
;/ LENGTH: 20
;/ T STATES: 92
;/ PROCESSOR: 6502
;
SNEG46:  LDA  £4     ; byte count          A9  04
         STA  ME     ; to memory.          85  ZZ
         LDX  £0     ; RAM point.          A2  00
         SEC         ; set carry initially. 38
SNG1:    LDA  £0     ; subtract byte       A9  00
         SBC  M1,X   ; from zero and       F5  ZZ
         STA  M1,X   ; store back to RAM.  95  ZZ
         INX         ; point to next byte. E8
         DEC  ME     ; all done?           C6  ZZ
         BNE  SNG1   ; jump if not.        D0  F5
         ASL  A      ; cy = sign.          0A
         RTS         ;                     60
```

Datasheet

```
;= SBAD46 — 32-bit binary to ASCII-Decimal conversion
;/ CLASS: 2
;/ TIME CRITICAL?: No
;/ DESCRIPTION:   Converts a signed 32-bit binary number to an
;/                ASCII-Decimal string.
;/ ACTION:        Make value absolute.
;/                If negative put "—" to RAM.
;/                Divide number by ten
;/                put remainder onto stack
;/                increment number of digits
;/                repeat until number = 0.
;/                Pop digit off stack
;/                convert to ASCII and load into RAM.
;/                Decrement number of entries
;/                repeat until number of entries = 0.
;/                Put ASCII CR into RAM for terminator.
;/ SUBr DEPENDENCE: SNEG46
;/ INTERFACES: None
;/ INPUT:         M1-M4 contains the signed 32-bit number for conversion
;/                with the least significant byte at M1 and the most
;/                significant at M4.
;/                MA,MB contain the RAM start address of the result.
;/ OUTPUT:        MA,MB are unchanged.
;/                The ASCII string equivalent is in RAM starting at
;/                the address given in MA,MB.
;/ REGs USED:     A,X,Y,P,M0 to M4,MA and MB.
;/ STACK USE:     10 maximum.
;/ LENGTH: 73
;/ T STATES: 13,007 maximum
;/ PROCESSOR: 6502
;
SBAD46:  LDY  £0     ; RAM point.          A0  00
         BIT  M4     ; test sign.          24  ZZ
         BPL  SBD1   ; skip if positive    10  08
         LDA  £$2D   ; else put "—"        A9  2D
         STA  (MA),Y ; to RAM,             91  ZZ
         INY         ; point to next RAM   C8
         JSR  SNEG46 ; and negate number   20  XX  XX
SBD1:    STY  M0     ; save RAM point.     84  ZZ
         LDY  £0     ; number of digits = 0. A0  00
SBD2:    LDX  £32    ; bit count = 32.     A2  20
         LDA  £0     ; zeroise accumulator A9  00
SBD3:    ASL  M1     ; shift               06  ZZ
         ROL  M2     ; number              26  ZZ
         ROL  M3     ; left                26  ZZ
         ROL  M4     ; into                26  ZZ
         ROL  A      ; accumulator         2A
         CMP  £10    ; is acc less than 10 ? C9  0A
         BCC  SBD4   ; skip if so, else    90  04
         SBC  £10    ; subtract ten        E9  0A
         INC  M1     ; and set a result bit. E6  ZZ
SBD4:    DEX         ; repeat              CA
         BNE  SBD3   ; 32 times.           D0  EC
         PHA         ; save digit.         48
         INY         ; increment no of digits. C8
         LDA  M4     ; check               A5  ZZ
         ORA  M3     ; if number           05  ZZ
         ORA  M2     ; is zero             05  ZZ
         ORA  M1     ; and                 05  ZZ
         BNE  SBD2   ; repeat if not.      D0  DC
         TYA         ; transfer            98
         TAX         ; Y to X.             AA
         LDY  M0     ; restore RAM point.  A4  ZZ
SBD5:    PLA         ; pop digit off stack, 68
         CLC         ; convert it          18
         ADC  £$30   ; to ASCII            69  30
         STA  (MA),Y ; and put into RAM.   91  ZZ
         INY         ; increment RAM point. C8
         DEX         ; get next            CA
         BNE  SBD5   ; digit, else         D0  F6
         LDA  £13    ; load ASCII CR       A9  0D
         STA  (MA),Y ; and put it to RAM.  91  ZZ
         RTS         ;                     60
```

APC SUBSET

Z80

Our set of Z80 numeric routines commences with a 32 bit integer divide routine called DIV4. It accepts the dividend in registers IX and IY, and the divisor in BC and DE. As documented in the data sheet, output is through the same registers containing quotient and remainder, respectively.

Datasheet

```
;= DIV4 — 4-byte integer divide.
;/ CLASS: 1
;/ TIME CRITICAL ? No.
;/ DESCRIPTION:   Divides one 4-byte unsigned integer by another.
;/                Returns quotient and remainder. Checks for
;/                divide by zero.
;/ ACTION: Long division by shift-and-subtract, using HL
;/         and (SP) as an extended accumulator.
;/ SUBr DEPENDENCE: None.
;/ INTERFACES: None.
;/ INPUT:  Dividend in IX,IY
;/         Divisor in BC,DE
;/ OUTPUT: Carry set, arguments unchanged if BCDE = 0 on entry.
;/         A is always set to zero.
;/         Quotient in IX,IY.
;/         Reminder in BC,DE.
;/ REGs USED: All normal and index registers (not alternate
;/            registers).
;/ STACK USE: 2
;/ LENGTH: 54
;/ PROCESSOR: Z80.

DIV4:   LD    A,B       ;if all                78
        OR    C         ;BC                    B1
        OR    D         ;DE                    B2
        OR    E         ;are zero              B3
        SCF             ;set carry             37
        RET   Z         ;and return.           C8
        LD    A,32D     ;set bit count.        3E 20
        LD    HL,0000H  ;set accumulator       21 00 00
        PUSH  HL        ;and extend to stack.  E5
TOP:    ADD   IY,IY     ;shift left IY.        FD 29
        EX    (SP),IX   ;get IX                DD E3
        EX    (SP),HL   ;into HL               E3
        ADC   HL,HL     ;shift it left (with carry)  ED 6A
        EX    (SP),HL   ;and return            E3
        EX    (SP),IX   ;it to IX.             DD E3
        ADC   HL,HL     ;shift HL left (with carry).  ED 6A
        EX    (SP),HL   ;get (SP) into HL      E3
        ADC   HL,HL     ;shift it left (with carry)  ED 6A
        EX    (SP),HL   ;and return it to (SP). E3
        OR    A         ;clear carry.          B7
        SBC   HL,DE     ;subtract              ED 52
        EX    (SP),HL   ;BC,                   E3
        SBC   HL,BC     ;DE                    ED 42
        EX    (SP),HL   ;from (SP),HL.         E3
        INC   IY        ;set result bit.       FD 23
        JR    NC,WENT   ;jump if               30 09
        JR    Z,WENT    ;subtraction went.     28 07
        ADD   HL,DE     ;else                  19
        EX    (SP),HL   ;add                   E3
        ADC   HL,BC     ;back                  ED 4A
        EX    (SP),HL   ;divisor               E3
        DEC   IY        ;and reset result.     FD 2B
WENT:   DEC   A         ;repeat                3D
        JR    NZ,TOP    ;32 times.             20 D9
        EX    DE,HL     ;put remainder from    EB
        POP   BC        ;(SP),HL to BC,DE.     C1
        RET             ;                      C9
```

The second Z80 routine is particularly useful for checking the status of input and output ports, or any other bit-mapped operations. The routine accepts a 16 bit quantity through HL and outputs a string of "1" and "0" characters to a buffer pointed to by DE. Clearly the outbuffer might be the screen itself on any machine with a memory mapped display.

Datasheet

```
;= CVBA — bit field to ASCII conversion.
;/ CLASS: 1
;/ TIME CRITICAL? No
;/ DESCRIPTION: Converts a 16-bit field to ASCII ones and zeroes
;/ ACTION:      B ← 16
;/              C ← ASCII zero (30H)
;/              Then repeat 16 times:
;/              A ← zero (00H)
;/                        HL
;/              Cy ← [15 — — 0] ← 0
;/              A ← C + Cy
;/              (DE) ← A
;/              DE ← DE + 1
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:   HL holds the bits to be converted
;/          DE holds the start address of the result
;/ OUTPUT:  HL = zero
;/          DE holds the end of conversion + 1 address
;/ REGs used: HL,DE
;/ STACK USE: 4
;/ LENGTH:  15
;/ T STATES: 781
;/ PROCESSOR: Z80

;
CVBA:   PUSH  AF        ;save                  F5
        PUSH  BC        ;registers.            C5
LD      LD    B,+16     ;set loop counter.     06 10
        LD    C,"0      ;set C to ASCII zero.  0E 30
CVB1:   XOR   A         ;zeroise A.            AF
        ADD   HL,HL     ;shift most sig bit to cy.   29
        ADC   A,C       ;add this to 30H in A. 89
        LD    (DE),A    ;store/display ASCII value.  12
        INC   DE        ;increment destination addr. 13
        DJNZ  CVB1      ;get next bit till all 10
        POP   BC        ;processed, restore    C1
        POP   AF        ;registers.            F1
        RET             ;                      C9
```

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Most assembly language enthusiasts have a library of handy routines that they have compiled over the years. We are eager to get our hands on these for publication in this series. They don't have to be long or technologically clever, just as long as they work and you can present them according to our documentation conventions outlined last month. Appropriate credit will be given in all cases.

APC SUB-SET will continue next month with more numeric routines.

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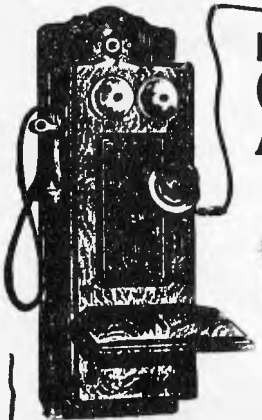

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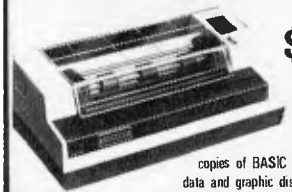

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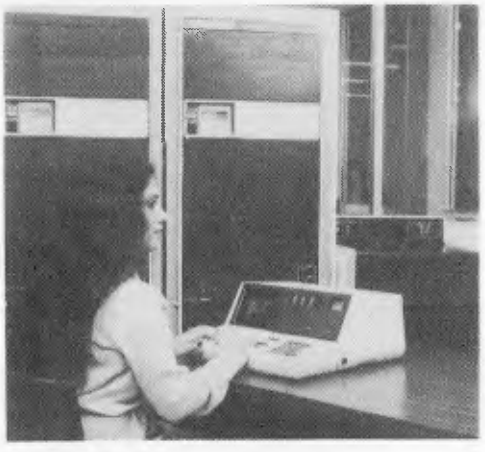

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While services like these used to cost tens of thousands of dollars to the government departments and large corporations who used them, they are now available to you for less than the cost of a packet of cigarettes a day for the 'average' user.

You can join the AUSTRALIAN BEGINNING by paying a one-time joining fee of $100, and a small hourly user charge of $10 an hour 8 a.m. - 6 p.m. and $4.50 an hour 6 p.m. - 8 a.m. weekdays and all weekends.

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Yes, I think the idea of the AUSTRALIAN BEGINNING is great! I enclose $100 so please send me my user manual and password.

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Model.....

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☐ *I am interested, but I need more information.*

DEALER INQUIRIES INVITED

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc. Organisers are requested to notify APC of forthcoming events well in advance to allow time for inclusion in 'Diary Data'.

Melbourne	Micro Computer Exhibition, SAE Australasian, (03) 347 2220	August 5, 1982
Sydney	Data 82, Centrepoint. Contact: Graphic Directions	August 10–12, 1982
Canberra	National Microcomputer Conference. Contact: MICSIG, ACS	August 18–20, 1982
Hobart	Ninth Australian Computer Conference. Telephone (002) 25 3129	August 23–27, 1982
Melbourne	Data 82, Melbourne Showgrounds	November 9–11, 1982
Sydney	The 1st Australian Personal Computer Show, Centrepoint. Contact: Australian Exhibition Services	March 10–12, 1983

NETWORK NEWS

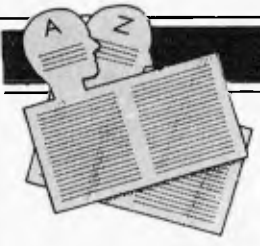
Here is a list of all Australian personal computer networks. As more networks appear – and as more facilities are added to existing ones – we'll report them in this section, which appears monthly.

The Australian Beginning. Operator: The Australian Beginning Pty. Ltd. 364 La Trobe Street, Melbourne. Tel: (03) 329 7998. Facilities: Information service, electronic mail, software storage, and software downloading. Hours: 24 hours/day, 7 days/week.

INFONET. Operator: Network Services Division of Computer Sciences of Australia Pty. Ltd., 460 Pacific Highway, St Leonards, NSW. Tel: (02) 439 0033. Facilities: Access to databases produced by the Australian Bureau of Statistics and the Institute of Economic and Social Research. Hours (E.S.T.): Monday to Friday (7am to 9pm), Saturday (8am to 5pm) and Sunday (8am to 11.30am).

AUSINET. Operator: ACI Computer Services, P.O. Box 42, Clayton, Victoria. Tel: (03) 544 8433. Facilities: Medium to databases whose subject coverage includes agriculture, education, energy, industry, public affairs, science and technology and an online Australian database directory. Hours: 8.30am to 9.00pm E.S.T. Monday to Friday.

IP Sharp Associates Network. Operator: IP Sharp Associates Pty. Ltd., 13th Floor, 175 Pitt Street, Sydney. Tel: (02) 232 6366. Facilities: The network is an international time sharing data processing network, the host computers being located in Toronto, Canada. Hours: 24 hours/day, 7 days/week.



USER GROUPS INDEX

Below is a list of alterations and additions to the list of user groups published in the March issue. Updates have been published in the April, May and June issues of APC; the next full listing will be published in the August issue.

APPLE USERS GROUP OF WA
The correct telephone number of the Secretary/ Treasurer, John Currie is Fremantle, 335 7257.

OSBORNE USERS GROUP
Forty Osborne Users attended the first Osborne Users meeting to be held in Australia. Mr Steve Freeman, General Manager of President Computers in Melbourne conducted the meeting from President Computers' Showroom Suite 1, 609 St Kilda Road, Melbourne. Those interested contact Roslyn Miller on (03) 529 1788.

CANBERRA COMPUCOLOR CLUB (CCC)
Intercolor and Compucolor users are welcome at meetings held at 7.30pm on the first Sunday of each month at the offices of Digital Equipment, 28 Lonsdale Street, Braddon. Telephone Jim Farquhar AH 41 2870 or Ken Kerrison BH 65 5417 or AH 73 3793.

CPU PEACH USERS CLUB
Recently formed for Peach users in Perth, other 6809 users are welcome at meetings. Those interested should contact Brendon Butcher on 367 5880 or write to the Secretary, 1 Charf Crt, Riverton 6155.

VIC 20 MELBOURNE USER GROUP
Meetings are held on the third Tuesday of every month, 7.30pm at Panatronics, 691 Whitehorse Road, Mont Albert. For further information contact Neil Brandy on 890 0579

CUVIE COMPUCOLOR/ ENTECOLOR MELBOURNE USER GROUP
Meetings are held on the first Tuesday of every month, 7.30pm at Panatronics, 691 Whitehorse Road, Mont Albert. For further information contact Keith Ochiltree on 82 8852.

SHMUNCK

by B. Christmas

This program utilises APC-80 for its sound and graphics.
SHMUNCK is a teacher/parent programmable maths game. It deals with whole numbers only, but both positive and negative numbers may be used. A selection of seven preprogrammed sets is also offered.

The program works on two number problems, i.e. one number (operand (+,–,X,≠;)) second number = answer. We will let operand show as () from now on. We will call these the first and second numbers.

The program allows us to set the size and range of each number by setting the boundaries or parameters in which the computer shall select at random, i.e. if parameters of 12,4 are selected for the first number and 8,6 for the second, we will always get problems in the range 12 () 8 = ? to 4 () 6 = ?

Also, if the same number is entered for both parameters of a number range, only that number will be used, e.g. entering 8,8 for the parameters of the first number, and 5,5 for the second, restricts the computer to the problem 8 () 5 = ?.

Normal size numbers may be used, with the understanding that numbers are selected at random in-between the set parameters. Thus, the difference in size of the parameters should be limited to the RND(n) limit, i.e. 32767.

Negative values may be set for any of these parameters, but the program will only accept them in order, i.e. enter highest value first, lowest value second. (The program asks for high and low values for first and second numbers.)

The balance of this explanation uses these terms.

Now that we understand what sort of information we will need to enter, we can move on. The program also allows us to select from 1 or more of the following operands, ADDITION SUBTRACTION MULTIPLICATION DIVISION.

If more than one is selected, the computer will pick from the selection at random.

Several things should be borne in mind.

i) If you wish to work in positive numbers only for Subtraction, the low parameter for the first number must be greater than the high parameter for the second, e.g. 12,4(first);3,1(second) must always be positive, i.e. 4-3=1 is the lowest answer obtainable.
BUT 12,4 ;5,1 may return 4-5=-1
ii) Always ensure that the second number parameters cover a number that will divide evenly into the range of the first number parameters for division selection. It does not matter if the answer will be positive or negative. e.g. 12,2 ; 12,4 is alright
BUT 12,2 ; 24,13 is not
(nothing in this divided into 12,2 will produce a whole number answer).

Zeros are not accepted by the program as divisor parameters, but otherwise are allowed for. The program covers any other combinations in division, and if an error occurs, it is because our old friend RND(n) has been asked to do too much again. The rules for this are complicated, but an FC error may occur if the range of ANSWERS in division exceeds 32767. If it happens, reduce either set of parameters.

Now, just to keep your head spinning, you may choose and program up to 12 levels. These may be used in several ways.

i) It allows coverage of the 1-12 multiplication tables (selection 1)
ii) It allows difficulty levels in the game (bonus points are awarded as the square of the level selected).
iii) Teachers may program problem levels for individual student requirements, or levels for groups who can

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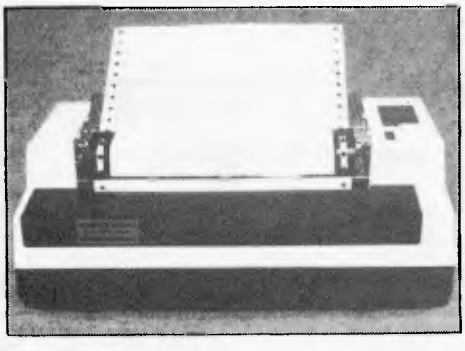

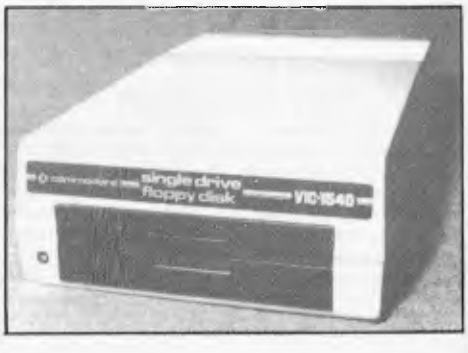

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This program will create the equivalent of a disk drive in your extra RAM memory.

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INCLUDING A NAME AND ADDRESS DEMONSTRATION PROGRAM

ISAM (Indexed Sequential Access Method) provides keyed access to data files for reading, writing, updating and deleting records within the file.
The whole purpose for storing information on the computer is to have the computer manage the information, print reports, and find upon request any particular piece of information. A good analogy is a public library where hundreds of books have been organised to make it easy to find any particular book. ISAM will be the librarian who possesses efficient skill in storing and retrieving records (books) in a file (library) by a record's "Key". A file of addresses can be stored using the name as the record's key. Any particular record is then retrieved by specifying the name. The actual location of a record within the file is of no concern to the user or the application. ISAM interfaces directly to your Basic programs through a few variables. Accessing ISAM is a simple as executing a call to a basic subroutine.
ISAM represents state-of-the-art software by using sophisticated techniques in its data architecture, sorting, searching, updating, dynamic disk space management, record buffering, searching by full key or by partial key, sequential retrieval in both a forward and backward direction, and accessing up to seven ISAM files simultaneously.
You also get a complete NAME AND ADDRESS program that demonstrates ISAMs simplicity and power.

FEATURES:

OPEN FILE	GET RECORD BY KEY
CLOSE FILE	GET NEXT RECORD
ADD RECORD	GET PREVIOUS RECORD
DELETE RECORD	GET FIRST RECORD
UPDATE RECORD	GET LAST RECORD
SORT FILE BY KEY	SHOW FILE STATISTICS

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Printed reports can be sent to the screen, the IBM parallel printer, or to a serial printer. **$99.95**

CROSS REFERENCE

Will list your basic program and print all of the variables used in the program. The line numbers following each variable are the lines on which the variable is used. The program also cross references all line referencing statements such as GOTO, GOSUB, ON-GOTO, ON-GOSUB, IF-THEN-ELSE, and RESTORE. You can easily determine if a line number is referenced by another part of the program.
The listing can be sent to the screen, the IBM parallel printer, or to a serial printer.

EXAMPLE: PROGRAM LISTING

```
820  Q$ = N$: J = 1: QL = 157
830  IF J> QL THEN Q = 0: RETURN
840  QM = (J + QL)/2
850  IF Q$<Q$ (QM) THEN QL = QM + 1: GOTO 830
860  IF Q$<Q$ (QM) THEN QL = QM - 1: GOTO
     830
870  Q = 1: RETURN
```

CROSS REFERENCE LISTING

```
2    830 FROM                 850  860
4    J ..................     820  830  840  850
1    N$ .................     820
2    Q ..................     830  870
3    Q$ .................     820  850  860
2    Q$( ) ..............     850  860
4    QL .................     820  830  840  860
5    QM .................     840  850  850  860  860
```

END OF LISTING **$24.95**

MINIMUM REQUIRED SYSTEM CONFIGURATION:
✓ IBM-PC WITH 48K MEMORY.
✓ 1 DISK DRIVE, DOS AND DISK BASIC.
✓ EITHER MONOCHROME OR COLOR/GRAPHICS

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is a collection of 10 great games to play on your IBM-PC. Even though you may have purchased your IBM for "Work", these games turn the computer into a fun machine for the whole family. Includes games for both youngsters and adults.
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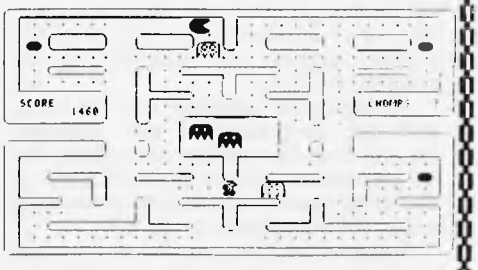

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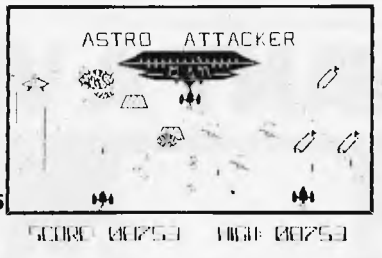

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THE AUSTRALIAN BEGINNING.
ID. WEIRPOBOASHF

work as a team on difficult problems, e.g. long division, long multiplication.

THE PROGRAM ITSELF

i) The name and score of the highest scoring player is kept.
ii) You, as the teacher/parent, may select a time for the game to run (1-5). Each unit gives about 40 seconds play time, + time for each SHMUNCK to "die".
iii) To reselect or reset parameters and keep score, type in "MENU" when the program asks for your name. (This comes up when you answer "N" when you are asked if you want another game).

This is not indicated anywhere during running, so keep it secret, it wipes the parameter settings!
iv) As the problem answer is typed in, the program monitors the answer, and if it is correct, it goes over to the game. However, if the answer is incorrect, it will allow one further figure to be typed in and then wipe the wrong answer, resetting for another try. One digit will be removed from the right of the answer if the backspace key is depressed, or the whole answer removed if the New Line key is used.

If you are programming you could program a "password" into the start instead of "MENU" or alter the DATA statements to suit your needs, and save your own version. The DATA statements are labelled to assist with this.

Also, as students seem to get bored after some time at the same game, the basic Maths core could be written around several different games to keep interest up. Perhaps APC-80 might publish some, to keep teachers armed with plenty of choices in their Educational ammo!

I am indebted to Eaglehawk Primary School for the "lend" of some students (we didn't exactly have to twist their arms). They pointed out the many 'blues' in the game (but sir, the aliens HAVE to shoot back). The students also graciously allowed the teachers to give me the data for the "EAGLEHAWK SPECIAL" (cries of "get back and let me in kids"). This covers the normal problems for years 4-6. (In whole numbers only, fractions will have to wait).

PARAMETER DATA FOR "SHMUNCK"

			ADDITION				SUBTRACTION				MULTIPLICATION				DIVISION			
LEVELS			H 1st	L	H 2nd	L	H 1st	L	H 2nd	L	H 1st	L	H 2nd	L	H 1st	L	H 2nd	L
SELECTIONS	1	1									12	1	1	1				
		2									12	1	2	2				
		3									12	1	3	3				
		4									12	1	4	4				
		5									12	1	5	5				
		6									12	1	6	6				
		7									12	1	7	7				
		8									12	1	8	8				
		9									12	1	9	9				
		10									12	1	10	10				
		11									12	1	11	11				
		12									12	1	12	12				
	2	1	10	1	10	1	10	1	10	1	5	1	5	1	25	1	5	1
		2	100	1	100	1	100	1	100	1	10	1	10	1	144	1	12	1
		3	1,000	1	1,000	1	1,000	1	1,000	1	20	1	20	1	144	1	144	1
	3	1													4	1	4	1
		2													12	1	4	1
		3													12	1	12	1
	4	1	10	1	10	1												
		2	20	1	20	1												
		3	40	10	40	10												
		4	100	1	100	1												
		5	1,000	1	1,000	1												
	5	1	50	10	49	1												
		2					99	50	49	1								
		3									99	10	10	1				
		4													144	0	12	1
		5	50	10	49	1	99	50	49	1	99	10	10	1	144	0	12	1
		6	500	100	499	50												
		7					999	500	450	99								
		8									499	99	100	11				
		9													999	99	99	11
		10	500	100	499	50	999	500	450	99	499	99	100	11	999	99	99	11
	6	1													300	100	60	10
		2													1,000	500	100	60
		3													30,000	1,000	600	100
	7	1									80	12	80	16				
		2									500	100	300	50				
		3									12,000	1,000	1,000	500				
		4									30,000	20,000	9,999	1,009				

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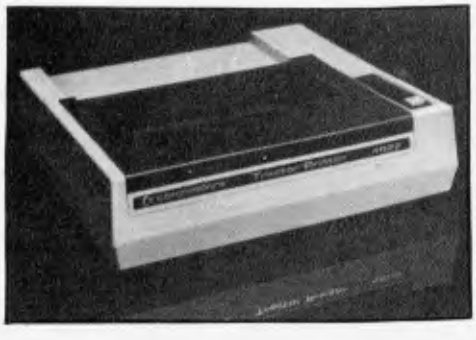

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The table gives the parameters for the 7 selections.

Users of the old System 80s and TRS-80s can substitute these lines for easier operation.

```
1060 T2=PEEK(14496): IF T2=16 AND T < 954 THEN T=T+2.2: PRINT@T-1," ";C5$;
1070 IF T2=64 AND T > 896 THEN T=T-2.2:PRINT@T, C5$;" ";
1470 PRINT@397, "USE SHIFT TO FIRE, < > KEYS TO MOVE";
```

```
10 CLEAR 1000
20 C5$=CHR$(128)+CHR$(128)+CHR$(184)+CHR$(143)+CHR$(180)+CHR$(128)+CHR$(128)
30 DIM V(12,4)
40 DIM I(12,4)
50 POKE 32303,0
60 GOTO 1360
70 '
80 ' BCHMUNCK SELECTION
90 '
100 C1$=CHR$(176)+CHR$(176)+CHR$(144)
110 C2$=CHR$(141)+CHR$(157)+CHR$(133)
120 C3$=CHR$(135)+CHR$(135)+CHR$(131)
130 C4$="SNUNCK":H1=20
140 RETURN
150 C1$=CHR$(176)+CHR$(176)+CHR$(176)
160 C2$=CHR$(189)+CHR$(191)+CHR$(190)
170 C3$=CHR$(143)+CHR$(131)+CHR$(143)
180 C4$="KLUNCK":H1=40
190 RETURN
200 C1$=CHR$(176)+CHR$(176)+CHR$(176)
210 C2$=CHR$(173)+CHR$(191)+CHR$(1158)
220 C3$=CHR$(170)+CHR$(128)+CHR$(149)
230 C4$="CHUNCK":H1=50
240 RETURN
250 C1$=CHR$(144)+CHR$(128)+CHR$(144)
260 C2$=CHR$(157)+CHR$(156)+CHR$(149)
270 C3$=CHR$(135)+CHR$(135)+CHR$(133)
280 C4$="FLUNCK":H1=60
290 RETURN
300 C1$=CHR$(176)+CHR$(176)+CHR$(144)
310 C2$=CHR$(158)+CHR$(159)+CHR$(148)
320 C3$=CHR$(135)+CHR$(131)+CHR$(133)
330 C4$="PLUNCK":H1=70
340 RETURN
350 '
360 Q=VAL(Q$)*1000:IF Q=0 THEN Q=2000:REM SELECTION OF LEVEL
370 '
380 CLS:PRINT@0,STRING$(64,153);
390 FOR K=62 TO 894 STEP 128:PRINT@K,A$;:PRINT@K+64,A1$;:NEXT
400 PRINT@896,STRING$(64,153);
410 K=70
420 FOR H=I TO X1
430 PRINT@K,"LEVEL ";H;:K=K+64
440 NEXT
450 PRINT@94,"* THE 5 OEAOLY SCHMUNCKB *";
460 FOR H=1 TO 5:ON H GOSUB 100,150,200,250,300
470 IF H=1 THEN H3=160 ELSE IF H=2 THEN H3=177 ELSE IF H=3 THEN H3=424 ELSE IF H=4 THEN H3=672 ELSE IF H=5 THEN H3=689
480 PRINT@H3,C1$;:PRINT@H3+64,C2$;:PRINT@H3+128,C3$;:PRINT@H3+188,C4$;"(";H;")"
490 PRINT@95B," ";:FOR K=1 TO 5:BEEP H*30,H+20:NEXT
500 NEXT
510 PRINT@834,"";
520 PRINT@836,"WHICH LEVEL";
530 INPUT X:IF X<1 OR X>X1 THEN 460
540 CLS
550 '
560 ' SET UP PROBLEM
570 '
580 Y=RND(4):IF I(X,Y)=0 THEN 580
590 V1=V(X,Y,1):V2=V(X,Y,2):V3=V(X,Y,3):V4=V(X,Y,4)
600 IF Y=4 THEN 640ELSE 800
610 '
620 'DIVISION PROCESSING
630 '
640 IF V2<>0 AND V2*-1=>V1 AND V3>V2*-1 THEN V3=V2*-1 ELSE IF V1<>0 AND V1=>V2*-1 AND V3>V1 THEN V3=V1
650 IF V2*-1 =>V1 AND V4=<V2 THEN V4=V2 ELSE IF V1>V2*-1 AND V4=<V1*-1 THEN V4=V1*-1
660 E1=V3-V4:IF E1=0 THEN V6=V3:GOTO 680ELSE IF E1=1 THEN V6=V3-RND(2)+1:GOTO 680
670 V6=V4+RND(E1+1)-1:IF V6=0 THEN 670
680 E2=V1/V6:E3=V2/V6:IF E2<>0 OR E2<-1 THEN E2=FIX(E2) ELSE E2=INT(E2)
690 IF E3<>0 THEN 700ELSE IF E3>-1 THEN E3=INT(E3) ELSE E3=FIX(E3)
700 IF E2<0 THEN E4=INT(E2-E3):GOTO 720
710 E4=INT(E2+E3)
720 IF E4=0 THEN V5=V1:V7=V5/V6:V7=FIX(V7):GOTO750ELSE IF E4=1 THEN V7=E2-RND(2)+1:GOTO 750ELSE IF E4=-1 THEN V7=E4:GOTO 750
730 IF E4<-1 THEN V7=(RND((E4-1)*-1)-1)*-1 ELSE V7=RND(E4+1)-1
740 V7=V7+FIX(E3)
750 IF V1<0 AND V2<0 AND RND(4)=1 THEN V7=V7*-1:GOTO 770
760 IF V1<-1 AND V6<0 AND V7<0 THEN V7=V7*-1
770 V5=V7*V6:IF V5>V1 OR V5<V2 THEN 670ELSE GOTO 860
780 '
790 ' +,-,/,*
800 E1=V1-V2:E2=V3-V4:IF E1>-2 AND E1<2 THEN V5=E1+V2 ELSE V5=RND(E1+1)+V2-1
810 IF E2>-2AND E2<2THEN V6=E2+V4 ELSE V6=RND(E2+1)+V4-1
820 ON Y GOTO 830,840,850,860
830 V7=V5+V6:PRINT@900,V5;"+";V6;"=";:GOTO 870
840 V7=V5-V6:PRINT@900,V5;"-";V6;"=";:GOTO 870
850 V7=V5*V6:PRINT@900,V5;"*";V6;"=";:GOTO 870
860 PRINT@900,V5;"/";V6;"=";:GOTO 870
870 B=906+LEN(STR$(V5))+LEN(STR$(V6))
880 FOR H=1 TO B-906:BEEP RND(20)+20,RND(20)+20:NEXT
890 PRINT@832,STRING$(B-892+LEN(STR$(V7)),"*");:PRINT@960,STRING$(B-892+LEN(STR$(V7)),"*");
900 IF Q2>0 THEN PRINT@922,"HIGHEST SCORE";Q2;"BY ";D2$;
910 FOR H=1 TO 100:NEXT
920 Q=Q-2:PRINT@986,"TIME LEFT";Q;:PRINT@320,"";:IF Q=<0 THEN 1950
930 IF R1<0 THEN R1=R1-1:GOTO 960ELSE R1=2:R=RND(5):ON R GOSUB 100,150,200,250,300
940 PRINT@J,"  ";:PRINT@J+64,"  ";:PRINT@J+128,"  ";
950 J=RND(59)+1:PRINT@J,CI$;:PRINT@J+64,C2$;:PRINT@J+128,C3$;
960 BEEP H1,30:C$=INKEY$:IF C$="" AND C$="." OR C$="-" THEN C$=C$+C$:PRINT@B,C$;:IF VAL(C$)=V7 THEN C$="":GOTO1010
970 IF PEEK(14400)=32 AND LEN(C$)>0 THEN C7$=LEFT$(C$,(LEN(C$)-1)):C$=C7$:PRINT@B,C$;" "
980 IF PEEK(14400)=1 THEN C$="":PRINT@B,"  ";
990 IF LEN(C$)=>LEN(STR$(V7)) THEN C$="":PRINT@B,"  ";
1000 GOTO 920
1010 C$="":FOR K=832 TO 960 STEP 64:PRINT@K,STRING$(62,128);:NEXT
1020 '
1030 '    GAME
1040 T=926
1050 PRINT@T,C5$;
1060 T2=PEEK(14400):IF T2=64 AND T<954 THEN T=T+2.2:PRINT@T-1," ";C5$;
1070 IF T2=32 AND T>896 THEN T=T-2.2:PRINT@T,C5$;" ";
1080 D=0-5:PRINT@960,C4$;" SCHMUNCK ";H1+10;"";" ";"TIME LEFT";Q;" ";"SCORE:";D1;" ";:PRINT@768," ";:BEEP H1,RND(20)+20:BEEP H1,10:20
1090 IF PEEK(14464)=1 THEN T3=(T-896)/2:REDRAW 12,40 TO 13,0:REDRAW 13,0 TO 13,40:GOTO1190
1100 IF J1<0 THEN J1=J1-1:GOTO 1110ELSE J1=RND(20)*10+RND(2)
1110 IF J1<28 GOTO 1120,1130
1120 IF J1>3 THEN:MOVE 15360+J TO 15584+J FOR J=J+2 TO J+J1*64:NEXT:GOTO1140ELSE J1=0:GOTO 1130
1130 IF J<57 THEN: MOVE 15584+J TO 15360+J FOR J=J+2 TO J+J1*64:NEXT:GOTO 1120
1140 IF RND(B)=1 THEN 1150ELSE I3=(T-896)/2+3:J=I3*2:FOR K=1 TO 3:BEEP 15,111:REDRAW J9,J TO 13,4:NEXT:Q=Q1-50
1150 IF Q=<0 THEN 1950ELSE GOTO 1060
1160 '
1170 REM TEST FIRING
1180 '
1190 FOR H=1 TO 10:BEEP H*H,H*10:NEXT:IF T=V7 AND T<>V5 THEN D=D+10:Q=Q+Y*X:PRINT@960,"BONUS";Q3;:GOTO1200ELSE Q1=Q1-50:GOTO 1060
1200 FOR W=1 TO 5
1210 BEEP H1*2+40,H1*3/W
1220 IF J<5 AND J<53 THEN PRINT@J+2-W,STRING$(W*2,"*");ELSE PRINT@J,"****";
1230 IF W=2 THEN PRINT@J+67-W,STRING$((W-1)*2,"*");
1240 IF W=3 THEN PRINT@J+133-W,STRING$((W-2)*2,"*");
1250 IF W=4 THEN FOR H=1 TO 60:NEXT
1260 NEXT
1270 BEEP 255,255
1280 FOR W=1 TO 5
1290 IF J<5 AND J<53 THEN PRINT@J+2-W,STRING$(W*2," ");
1300 IF W=2 THEN PRINT@J+67-W,STRING$((W-1)*2," ");
1310 IF W=3 THEN PRINT@J+133-W,STRING$((W-2)*2," ");
1320 NEXT
1330 FOR H=1 TO 40:NEXT
1340 R1=0:PRINT@0,STRING$(64,128);:PRINT@I,"  ";:GOTO 580
1350 '
1360 REM  PROGRAM SELECTION
1370 '
1380 A$=CHR$(153)+CHR$(153)+CHR$(166)+CHR$(166):A1$=CHR$(166)+CHR$(166)+CHR$(153)+CHR$(153):AB$="**********"
1390 CLS:X=1:T=1:Z=1
1400 B1$="PLEASE ENTER":B2$=" HIGHEST":B3$=" LOWEST":B4$=" VALUE OF FIRST NUMBER ":B5$=" VALUE OF SECOND NUMBER ":B9$=CHR$(191)
1410 B8$=""
1420 PRINT@0,STRING$(64,153);
1430 FOR J=62 TO 894 STEP128:BEEP RND(40)+20,RND(30)+30:PRINT@J,A$;:PRINT@J+64,A1$;:NEXT
1440 PRINT@896,STRING$(64,153);
1450 PRINT@259,"W E L C U M E  T O  T H E  G A M E  O F  S C H M U N C K";
1460 PRINT@333,STRING$(58,"-");
1470 PRINT@397,"USE SHIFT TO FIRE,ARROW KEYS TO MOVE";
1480 PRINT@521,"EACH MISSED SHOT AND ENEMY HIT TAKES 50 POINTS";
1490 PRINT@648,"WRITTEN BY B.CHRISTMAS : 1977-82";
1500 FOR J=1 TO 2000:NEXT
1510 IF D=1 THEN PRINT@645,"PLEASE ENTER YOUR NAME";:INPUT D$
1520 IF D$="MENU" THEN D$="":D=0:FOR X=1TO12:FORY=1TO4:FORZ=1TO4:V(X,Y,Z)=0:I(X,Y,Z)=0:NEXT:NEXT:NEXT:RESTORE:GOTO 1490ELSE IF D=1 THEN 60
1530 PRINT@704,"TEACHERS,DO YOU WISH TO ENTER YOUR OWN PARAMETERS?(Y/N)";
1540 A$=INKEY$:IF A$="Y" THEN Q=1:GOTO1550ELSE IF A$="N" THEN 2050ELSE 1540
1550 PRINT@772,"ENTER THE NUMBER OF DIFFICULTY LEVELS YOU WANT(1-12)";:INPUTX1:IF X1<1OR X1>12 THEN 1550
1560 PRINT@772,"PLEASE PUSH THE REQUIRED PLAY TIME (1 TO 5)                ";:Q*=INKEY$:IF Q*="" OR Q*>"5" THEN 1560ELSE Q=VAL(Q*)*1000
1570 CLS:PRINT" THIS IS DESIGNED TO BE AN INCENTIVE GAME FOR MATHS STUDENTS;"
1580 PRINT:PRINT" THE STUDENTS HAVE TO CORRECTLY ANSWER MATHS PROBLEMS TO PLAY A GAME OF SCHMUNCK ;YOU MAY SET THE TYPE AND LEVEL OF PROBLEMS IN"
1590 PRINT"UP TO TWELVE LEVELS;PLAYING THE HIGHER LEVELS GIVES EXTRA BONUS POINTS"
1600 PRINT:PRINT" AS THE PROGRAM ASKS FOR YOUR TEACHING REQUIREMENTS,PLEASE TYPE THEM IN,AND ENTER THEM WITH THE # NEW LINE # KEY"
1610 PRINT:PRINT@956,"PUSH ANY KEY TO CONTINUE";:IF INKEY$="" THEN 1610ELSE 1620
1620 IF PEEK(14400)=1 THEN 1620
1630 CLS:PRINT"LEVEL";X;PRINT"  1=ADDITION  2=SUBTRACTION  3=MULTIPLICATION  4=DIVISION "
1640 PRINT@512,"PLEASE PUSH THE CORROSPONDING NUMBERS TO SELECT";:PRINT@960,STRING$(40,128);
1650 B$=INKEY$:IF B$="1" THEN I(X,1)=1:PRINT@130,AB$; ELSE IF B$="2" THEN I(X,2)=1:PRINT@144,AB$; ELSE IF B$="3" THEN I(X,3)=1:PRINT@162,AB$; ELSE IF B$="4" THEN I(X,4)=1:PRINT@178,AB$;
1660 PRINT@640,"DO YOU WISH TO ALTER THESE SELECTIONS ? (Y/N IF FINISHED)     ";
1670 IF PEEK(14600)=2 THEN I(X,1)=0:I(X,2)=0:I(X,3)=0:I(X,4)=0:GOTO1630ELSE IF PEEK(14594)=64 THEN 1680ELSE 1650
1680 PRINT@960,"** ENTER NUMBERS WITH N/L KEY **";
1690 J=194:PRINT@512,0;
1700 IF I(X,Y)=0 THEN Y=Y+1:J=J+16:GOTO 1710ELSE 1720
1710 IF Y=5 THEN Y=4:GOTO 1860ELSE 1700
1720 PRINT@524,G2$;G4$;:PRINT@J+190,"H ";B9$;:INPUTV(X,Y,Z):PRINT@J,V(X,Y,Z);:PRINT@J+190,B8$;
1730 Z=2
1740 PRINT@524,G3$;G4$;:PRINT@J+196,"H ";B9$;: INPUT V(X,Y,Z):PRINT@J+6,V(X,Y,Z);:PRINT@J+196,B8$;
1750 IF V(X,Y,Z)<V(X,Y,Z-1) THEN 1760ELSE 1770
1760 FOR H=1 TO 30:PRINT@512,"NUMBERS INCORRECT VALUE -  H/L";:FOR K=1 TO 6:NEXT K:PRINT@512,STRING$(48,128);:FOR K=1 TO 3:NEXT K:NEXT:Z=1:PRINT@512,G1$;:GOTO1720
1770 Z=3:IF Y=1 THEN PRINT@J+64,"+";ELSE IF Y=2 THEN PRINT@J+64,"-";ELSE IF Y=3 THEN PRINT@J+64,"*";ELSE IF Y=4 THEN PRINT@J+64,"/";
1780 PRINT@524,G2$;G5$;:PRINT@J+190,"L ";B9$;:INPUTV(X,Y,Z):PRINT@J+128,V(X,Y,Z);:PRINT@J+190,B8$;
1790 Z=4
1800 PRINT@524,G3$;G5$;:PRINT@J+196,"L ";B9$;:INPUTV(X,Y,Z):PRINT@J+134,V(X,Y,Z);:PRINT@J+196,B8$;
1810 IF V(X,Y,Z)<V(X,Y,Z-1) THEN 1850
1820 IF V(X,Y,Z)=0 AND Y=4 THEN 1840ELSE IF V(X,Y,Z-1)=0 AND Y=4 THEN 1840
1830 GOTO 1860
1840 FOR H=1 TO 15:PRINT@512,"ZERO IS AN ILLEGAL PARAMETER FOR LOW IN DIVISION";:FOR K=1 TO 6:NEXT K:PRINT@512,STRING$(54,128);:FOR K=1 TO 3:NEXT K:NEXT:GOTO 1770
1850 FOR H=1 TO 30:PRINT@512,"NUMBERS INCORRECT VALUE -  H/L";:FOR K=1 TO 6:NEXT K:PRINT@512,STRING$(48,128);:FOR K=1 TO 3:NEXT K:NEXT:Z=3:PRINT@512,G1$;:GOTO 1780
1860 Z=1:IF Y=4 THEN Y=1:J=194:GOTO 1870ELSE Y=Y+1:J=J+16:GOTO 1700
1870 B*=INKEY$:IF B*="Y" THEN PRINT@512,STRING$(90,128);:GOTO1690ELSE IF B*="N" THEN 1880ELSE 1870
1880 IF I(X,1)=0 AND I(X,2)=0 AND I(X,3)=0 AND I(X,4)=0 THEN 1890ELSE 1900
1890 FOR K=1 TO 40:PRINT@512,"YOU DID NOT ENTER ANY SELECTIONS";:PRINT@512,BTRIN$(90,128);:FOR K=1 TO 3:NEXT:NEXT:GOTO 1630
1900 IF X=X1 THEN 1910ELSE X=X+1:GOTO 1630
1910 Q=1:GOTO 1360
1920 '
1930 ' ANOTHER GAME?
1940 '
1950 FOR Q=1 TO 200:NEXT
1960 CLS:PRINT@468,"DO YOU WANT TO PLAY AGAIN ? (Y/N)";
1970 Q1=Q1+Q3:PRINT@202,"YOUR SCORE WAS "Q1;:D$
1980 IF Q1>Q2 THEN Q2=Q1:D2$=D$
1990 IF Q2>0 THEN PRINT@580,"HIGHEST SCORE IS";Q2;" BY ";D2$;
2000 Q1=1:Q3=0
2010 B$=INKEY$:IF B$="Y" THEN 360ELSE IF B$="N" THEN 1360ELSE 2010
2020 '
2030 ' PRE-PROGRAMMED SELECTION
2040 '
2050 FOR K=130 TO 834 STEP 64:PRINT@K,STRING$(60,128);:NEXT
2060 PRINT@136,"PLEASE SELECT FROM THE FOLLOWING";
2070 PRINT@260,"1 :: MULTIPLICATION TABLES 1-12";
2080 PRINT@324,"2 :: 3 LEVELS OF RANDOM SELECTION";
2090 PRINT@388,"3 :: 3 LEVELS OF DIVISION";
2100 PRINT@452,"4 :: 5 LEVELS OF ADDITION";
2110 PRINT@516,"5 :: EABLEHAWK SPECIAL:10 LEVELS";
2120 PRINT@580,"6 :: 5 LEVELS LONG DIVISION";
2130 PRINT@644,"7 :: 4 LEVELS MULTIPLICATION";
2140 PRINT@839,"PLEASE WAIT AFTER SELECTING";:PRINT@958,"  ";
2150 B*=INKEY$
2160 IF B*="1" THEN 2200ELSE IF B*="2" THEN 2280ELSE IF B*="3" THEN 2340ELSE IF B*="4" THEN 2420ELSE IF B*="5" THEN 2490
2170 IF B*="6" THEN 2630ELSE IF B*="7" THEN 2700
2180 GOTO 2150
2190 '
2200 REM  INPUT MULTIPLICATION TABLE DATA
2210 '
2220 Y=3
2230 FOR X=1 TO 12:FOR Z=1TO4
2240 READ H@:V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEP RND(20)+20,10
2250 NEXT:NEXT
2260 X1=12:D=1:GOTO 1360
2270 '
2280 FOR H=1 TO 48:READ H@:NEXT
2290 FOR X=1 TO 3:FOR Y=1TO4:FOR Z=1TO4
2300 READ H@:V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEPRND(20)+20,10
2310 NEXT:NEXT:NEXT
2320 X1=3:D=1:GOTO 1360
2330 '
2340 FOR H=1 TO 96:READ H@:NEXT
2350 Y=4
2360 FOR X=1 TO 3:FORZ=1TO4
2370 READ H@
2380 V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEP RND(30),25
2390 NEXT:NEXT
2400 X1=3:D=1:GOTO 1360
2410 '
2420 FOR H=1 TO 108:READ H@:NEXT
2430 Y=1
2440 FOR X=1 TO 5:FOR Z=1TO4
2450 READ H@:V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEP RND (30)+20,30
2460 NEXT:NEXT
2470 X1=5:D=1:GOTO 1360
2480 '
2490 FOR H=1 TO 128:READ H@:NEXT
2500 Y=0
2510 FOR X=1 TO 4
2520 Y=Y+1
2530 FOR Z=1 TO 4
2540 READ H@:V(X,Y,Z)=VAL(H@):V(5,Y,Z)=VAL(H@):I(5,Y)=1:I(X,Y)=1:BEEP RND(50)+20
2550 NEXT:NEXT
2560 Y=0
2570 FOR X=6 TO 9
2580 Y=Y+1
2590 FOR Z=1 TO 4
2600 READ H@:V(X,Y,Z)=VAL(H@):V(10,Y,Z)=VAL(H@):I(10,Y)=1:I(X,Y)=1:BEEP RND(20)+10,RND(50)+20
2610 NEXT:NEXT
2620 X1=10:D=1:GOTO 1360
2630 Y=4
2640 FOR H=1 TO 160:READ H@:NEXT
2650 FOR X=1 TO 3:FOR Z=1 TO 4
2660 READ H@:V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEP 50,50
2670 NEXT:NEXT
2680 X1=3:D=1:BOTO 1360
2690 '
2700 Y=3
2710 FOR H=1 TO 172:READ H@:NEXT
2720 FOR X=1TO4:FORZ=1TO4
2730 READ H@:V(X,Y,Z)=VAL(H@):I(X,Y)=1:BEEP 100,20
2740 NEXT:NEXT
2750 X1=4:D=1:GOTO 1360
2760 '
2770 ' SELECTION 1
2780 DATA 12,1,1,1,12,1,2,2,12,1,3,3
2790 DATA 12,1,4,4,12,1,5,5,12,1,6,6
2800 DATA 12,1,7,7,12,1,8,8,12,1,9,9
2810 DATA 12,1,10,10,12,1,11,11,12,1,12,12
2820 'SELECTION 2
2830 DATA 10,1,10,1,10,1,10,1,5,1,5,1,25,1,5,1
2840 DATA 100,1,100,1,100,1,100,1,10,1,10,1,144,1,12,1
2850 DATA 1000,1,1000,1,1000,1,1000,1,250,1,20,1,144,1,144,1
2860 'SELECTION 3
2870 DATA 4,1,4,1,12,1,4,1,12,1,12,1
2880 'SELECTION 4
2890 DATA 10,1,10,1,20,1,20,1,40,100,40,100,1,1000,1,1000,1,1000,1
2900 ' SELECTION 5
2910 DATA 50,10,49,1,99,50,49,1,99,10,10,1,144,9,12,1
2920 DATA 500,100,499,50,999,500,450,49,499,99,100,11,999,99,99,11
2930 ' SELECTION 6
2940 DATA 500,100,60,10,1000,500,100,60,30000,1000,600,100
2950 'SELECTION 7
2960 DATA 80,12,80,16,5000,100,500,50,12000,1000,1000,500,30000,2000,9999,1000
```

The author advises that he is prepared to send tapes to people who can't be bothered typing in the program. Those interested should send $10 to Mr Brian Christmas, Webster Street, Eaglehawk, Vic 3556. Profits will be donated towards a computer for his school.

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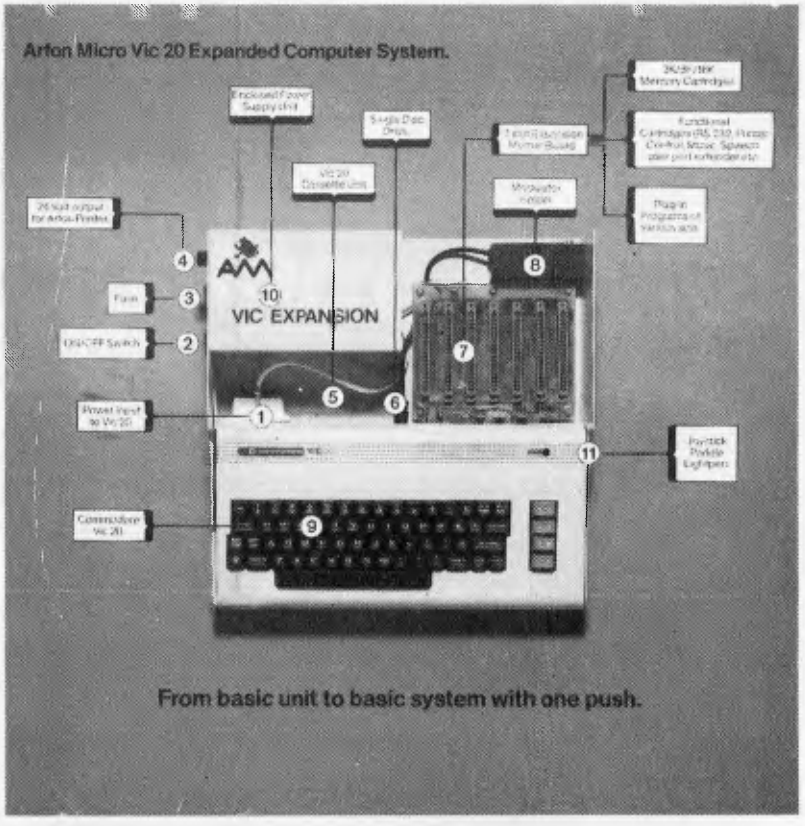

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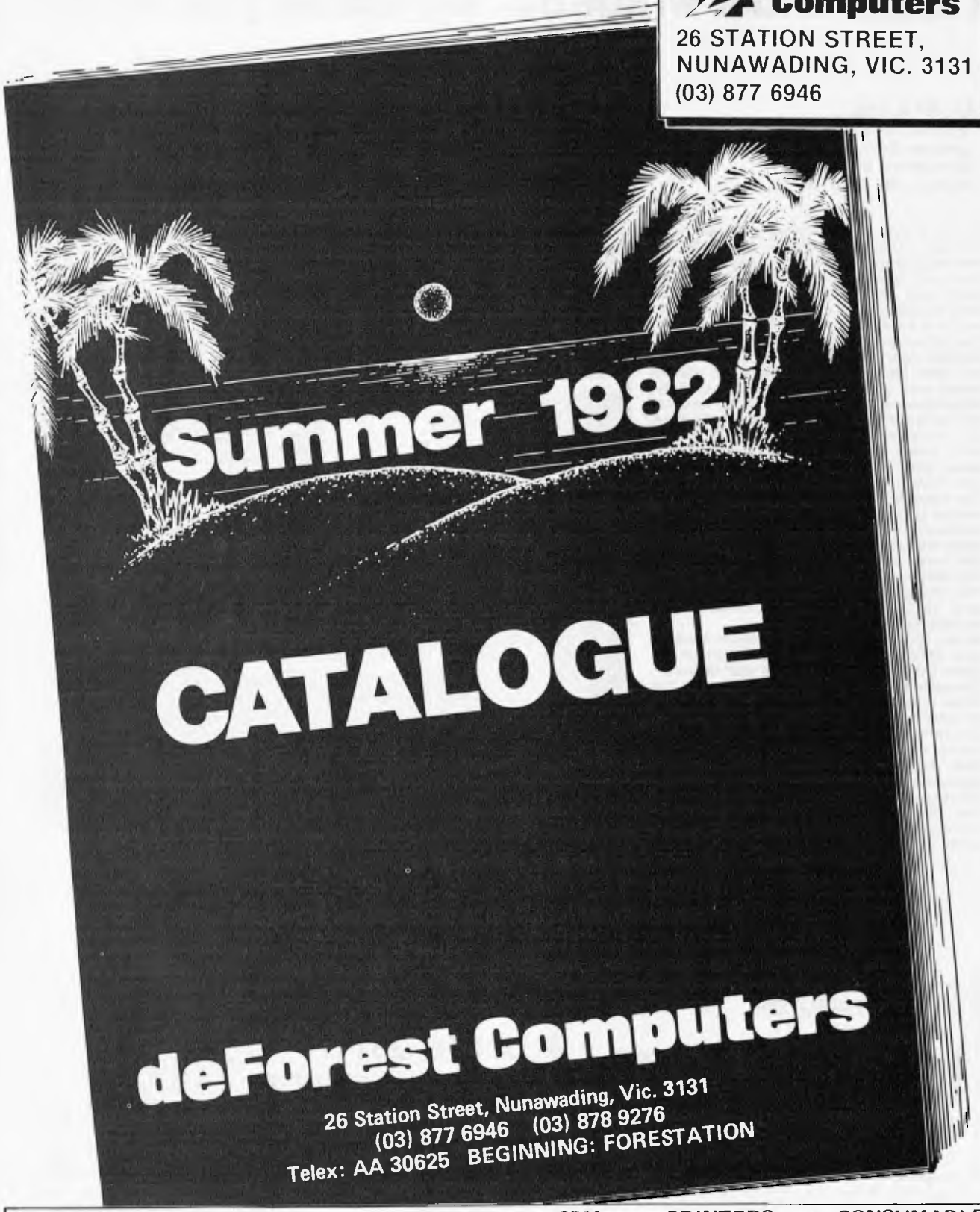

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LAZING AROUND

by J J Clessa

There was a very good response to our puzzle about the committee of the ladies' golf club — about 70 entries, mostly with the correct solution. The answer was beautifully given in verse by R Farquhar who wrote:

When all the votes were counted
And all the likes and dislikes reckoned,
The captain's place went Audrey's way
With Freda closely second.
Wee Betty became treasurer,
But what a fuss. I guess
If that's the kind of folk who play
Golf, I'll stick to Chess.

Nice one, but unfortunately your name was not the random selection. That honour went to L. Davidson — your prize is on its way.

Meanwhile, thanks for all the ideas for puzzles that some of you send in from time to time. It's not always possible to use them, for a variety of reasons, but whenever we do, we certainly acknowledge the originator. Keep the ideas flowing.

QUICKIE

Using the symbols +, —, / or *, rearrange four fives to equal the numbers one to ten. For example 5/5 * 5/5 =1; 5/5 + 5/5 =2, etc.

PRIZE PUZZLE

By subtracting two million from a perfect cube, a number can be obtained which is itself a perfect square of one of the factors of two million. What is that factor (all numbers are positive integers)? Answers, on postcards only please, July Prize Puzzle, *APC*, P.O. Box 280, Hawthorn, 3122, to arrive not later than 30 August.

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Continued from page 20

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Benchmarks

The calculator Benchmark (which I found in an article in the US magzaine *Microcomputing)* consists of a program to evaluate the expression:

$$P=I\sum_{J=1}^{N}(1+Y)^{-J}+M(1+Y)^{-N}$$

with M=20,000, I=1400, N=50 and Y=0.08. (Answer is 17553.30307.) The formula is, in fact, used to calculate bond yields in the financial world. I was attracted to this formula for two reasons, the first being that I liked the idea of a complex expression similar to those encountered in real life applications and the second being that the author listed Benchmark timings for several popular calculators using this expression and, in addition, a figure for the size of the program and the percentage of total memory used

The four parameters — M, I, N and Y — must be input to the running program from the keyboard.

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BENCHTEST
BUSINESS SYSTEM

MONROE 8820

Peter Rodwell tests one of the latest upmarket business micros from the States.

Monroe is an American company which has for some years now been known for its desk-top calculators; I'm sure you know the sort — those large things the size of a portable typewriter which professional number-handlers who don't actually require computing power still buy because, unlike pocket calculators, they're built to take a real pounding.

However, people must move with the times and, even if you don't need programmability or data storage facilities, you're supposed to have a desk-top computer these days; calculators are definitely not what the up-and-coming accountant wants seen on his desk.

Perhaps sensing this trend, Monroe has taken the logical step of going into the personal computer market. It still makes those large calculators (presumably there are still people around who just won't let go of an old technology), although they're no longer on sale in this country.

Two basic models make up the Monroe range: the OC 88XX, a business (or 'occupational', as the Monroe brochure puts it) micro, and the EC 8800, a rather nice-looking educational model with colour graphics, not yet available over here. Two business models are made, the OC 8810, which has a single minifloppy disk and the OC 8820, which has twin disks. This Benchtest is of the OC 8820.

Hardware

The 8820 is an all-in-one computer with the electronics, keyboard, screen and disks housed in a well-made and quite heavy two-tone beige ABS casing measuring 53cm deep by 48cm wide by 29cm high. The whole unit is solidly constructed and has a feeling of real quality about it — you're left in no doubt that this is a serious piece of office equipment, built to take the pounding of day in, day out commercial life.

The keyboard has 93 keys, arranged in six groups. The main group is, of course, a full qwerty keyboard of typewriter pitch and with a nice solid feel, eminently suitable for touch-typing. To its right is a numeric pad with arithmetical operators, and beyond this is a column of cursor control keys topped with a clear/home key. A solitary red key labelled 'STOP' sits in the upper left corner; to its right is a row of two blocks of four programmable function keys such as editing and caps lock controls. All the keys auto-repeat when depressed for longer than a second or so.

The 22.5cm screen at first looks rather small but in fact, when you're seated at the machine and using it, it's just fine. The screen provides the first surprise of the system; it has orange lettering on a grey background. I found this fairly weird at first, being used to green on black, but I soon got used to it and found it quite pleasant to work with. The 80 x 24 display is rock-steady and clear, the lettering having true descenders, although it was slightly blurred around the edges of the screen. The full ASCII character set can be displayed plus a range of 'chunky' graphics; the latter are displayed not directly from the keyboard but by sending the appropriate codes to the screen from a program. Characters can also be displayed in double height, double width, inverse video or dimmed. A brightness control is mounted just below the screen in the form of a thumbwheel protruding downwards from the bezel.

The twin minifloppy disks are mounted horizontally, one above the other, to the right of the screen. The disks, made by Micropolis, are single-sided, double density soft-sectored units holding 320k each. They are almost silent in operation, making only a slight 'clunk' when they turn off and on.

Inside, a 3MHz Z80 sits at the centre of things, with 128 kbytes of RAM to play with plus 4k of video RAM and a 2k bootstrap PROM.

Along the bottom edge at the back is a row of connectors with which the Monroe communicates with the outside world. Three of these are RS232 ports, labelled 'Printer', 'Communication I/O' and 'Auxiliary service I/O'; the latter is designed for service engineers — a troubleshooting ROM pack plugs into it to aid with system diagnostics. Two other, larger connectors are labelled 'Expansion bus' and 'External disk' — more on these later. The reset switch is mounted at the back, too, but the on/off switch lives on the left side, low down towards the back.

A final note on the hardware design: this is one of the quietest machines I have come across (among those which have disks, of course). Not only are the disk drives virtually silent, but so is the fairly powerful fan.

Operating system

The mention a few paragraphs earlier that the system has 128k of RAM will have already alerted you to the fact that the Monroe is somewhat different to the majority of 8-bit machines now on the market. This difference gets larger the deeper one probes into the machine.

Although CP/M is available as an option, the standard operating system which comes with the machine is Monroe's own operating system, which I'll be abbreviating here to MOS, and which bears no relation to CP/M whatsoever.

MOS is a single-user multi-tasking operating system which takes the form of 43 kbytes of 'core' software (ie, it sits in memory all the time) plus a number of utility programs which reside on disk and are called in as needed.

On power-up, or on hitting reset, the system first performs a memory check (which takes seven seconds, during which a message on the screen tells you what's happening) and then, to the

accompaniment of a 'waiting' message on the screen, searches both disk drives for a disk containing MOS. It will boot from either drive but drive 0, the lower drive, is the preferred one. The operating system, all 43k of it, takes 10 seconds to load, during which the screen message changes to 'Loading'; once it's running, a green LED next to the disk drives lights up to say that MOS is active.

CP/M contains certain intrinsic commands such as 'DIR', the directory command, which are executed directly by the operating system without the need to load and run a separate program resident on disk. MOS has no such intrinsic commands; it considers anything typed in at the keyboard to be the name of a program on disk and goes to look for it on the currently-active drive, giving a terse error message if it can't find it.

To describe MOS in full detail would require a separate review of considerable length. The following description is, then, more a brief run-through of the system's facilities than an in-depth study.

Each utility program is kept on disk as a task file (the equivalent to a CP/M 'com' file — ie, a directly-executable program).

Allocate: allocates space on a disk as a direct-access file, either binary or ASCII.

Bootgen: used when creating a new disk; it tells the bootstrap loader where to find the operating system on the disk.

Close: takes a specified device off-line; has to be used before you remove a disk from the system.

Command: similar to, but more versatile than, CP/M's 'Submit'. This allows you to execute a number of commands by creating a text file of the commands and handing this to Command for execution. We'll discuss this in depth later.

Copya: this transfers ASCII between two devices; not only can this be used for copying, but it can also function between, say, the keyboard and a disk, so that the text can be typed straight onto disk.

Copyi:: this performs an image copy between devices and/or files. It would be used, for example, for making back-up copies of disks.

Copylib: a fast transfer copy program; it can also be used to delete programs and operates in either an interactive or automatic mode.

Copyt: used for copying task files; task files can be either absolute or relocatable and this utility will copy either.

Creindex: allocates and creates an ISAM (indexed sequential access method) file.

Delete files: does exactly that.

Diskcheck: It's necessary to close files before changing a disk or switching off. If you forget to do this, Disckcheck gives you the chance to repair the damage by closing any files left open on the disk.

Diskinit: initialises a disk after it has been formatted by giving it a volume name and bit map.

Format: formats a blank disk.

Lib: display a disk directory. Typing L displays just the file names (which can be up to 12 characters long) and the type of file: Tsk for task, Asc for ASCII, Bac for Basic, etc. Typing L, F displays this information plus a good deal more, such as file sizes and the date and time they were created and last used.

Open: brings a device on-line; if you're using drive 0 and you want to see what's on the disk in drive 1, you have to close drive 0 and open drive 1 first before typing L for Lib.

Option: each file has certain attributes, which can be changed with this utility. Thus a file can remain in memory after execution or be deleted from it; and a task can be aborted by another task or not.

Priority: as MOS is a multi-tasking operating system, tasks can be given priorities to determine their order of operation. That's what this does.

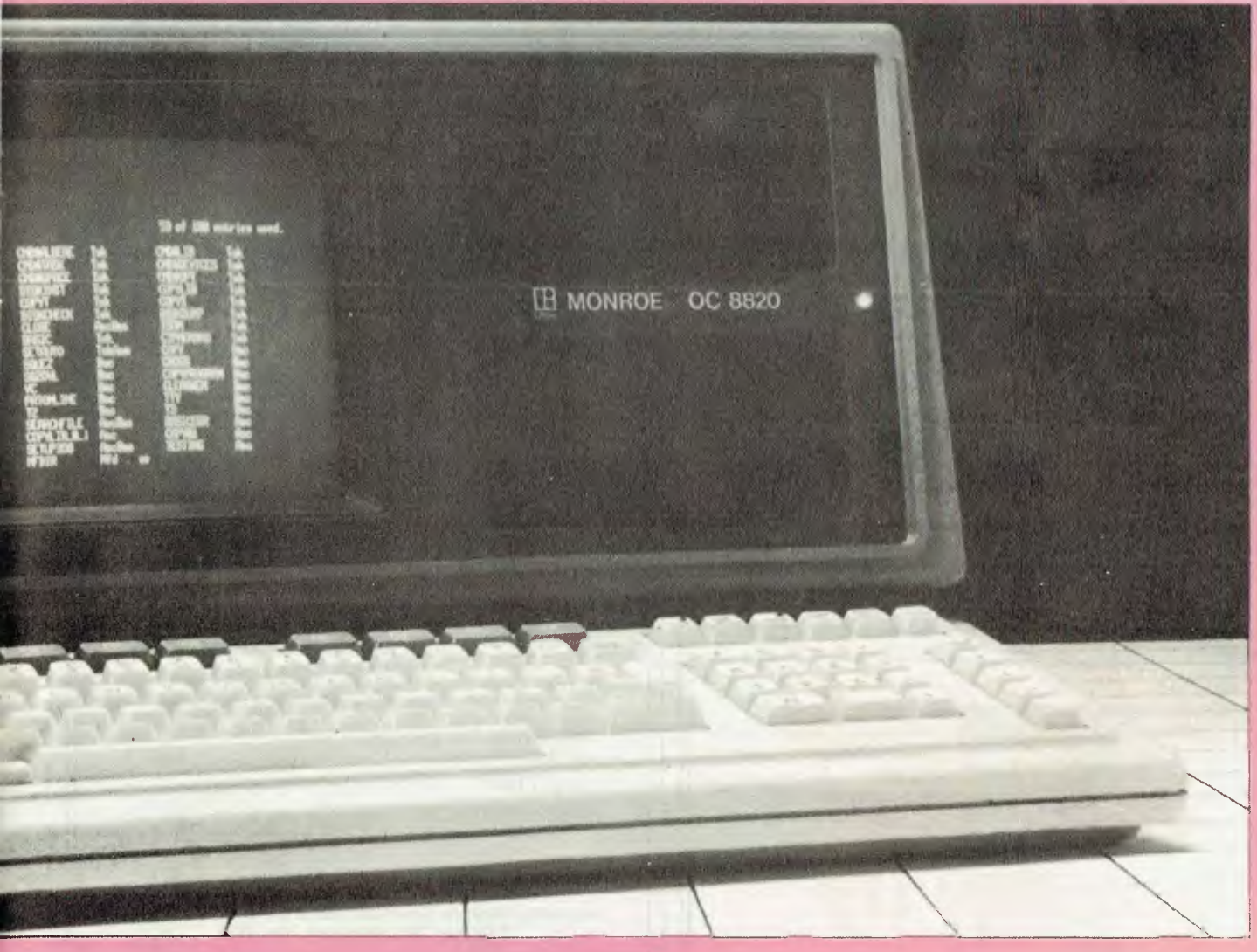
Rename: renames a file.

Space: tells you how much space is left on a disk, in *sectors*, which isn't as immediately useful as a kbytes read-out would be.

Set: enables the creation of an auto-start disk, ie, one which would immediately start an application program on boot-up without the user having to work through a sequence of operating system commands.

Sort: sorts out the contents of a file, including ASCII and numeric data files.

Time: sets the internal clock/



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calendar. Unfortunately this is a software clock/calendar, so re-booting the operating system, such as is necessary when changing a disk, sets it to zero again. A hardware clock/calendar would have been more practical.

Vol: sets or changes the names of the system volume (ie, disk).

The above are all utilities associated with the system itself. An additional set of utilities is provided under the general classification of task handling utilities as follows:

Cancel: this cancels a task which is either current or in memory but dormant.

Continue: continues a task which has been paused.

Devices: displays information, including current status, of all the devices in the system.

Load: this loads one or more tasks into memory to allow multitasking to take place. The tasks are loaded in sequence and activated using the Start utility (see below).

Pause: this simply pauses a specified task.

Run: this combines the Load and Start utilities; tasks are brought into memory and immediately executed.

Slice: during multitasking, work is scheduled according to each task's priority or according to time slices within that priority. If two tasks have an equal priority, the first in the queue will take all the processor's time until it's finished. Slice allows you to allow them to execute simultaneously by allocating time slices (in milliseconds).

Start: as mentioned earlier, this initiates tasks which have previously been Loaded into memory.

Task: lists the status of each task currently in memory, showing its priority, status, etc.

At first sight, MOS appears both complicated and unfriendly, particulary if, like me, you have become accustomed to CP/M and its many and varied idiosyncrasies. The profusion of copying utilities, for example, seems very confusing at first; and there's no easy way to find out what's on one disk if you're logged into the other — you have to type 'Close fpy0: open fpy1:' and then Lib, for example, if you're logged onto the lower drive and want to see the directory of the disk in the other drive. Compare this to the equivalent CP/M command, DIR B:.

Keyboard feels nice and solid

But a closer look at the utilities not only reveals that things are not as bad as they seem but shows the philosophy behind the Monroe System.

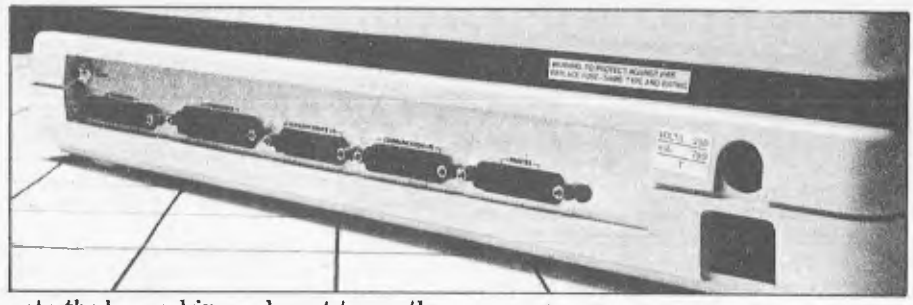
A microcomputer system will be used by two types of users — programmers and end users. In our Benchtests, we look at systems from the end user's point of view, mostly, although the programmer's angle obviously cannot be neglected. Looking at this machine as an end user, it appears awkward, unfriendly, overly complex and unnecessarily nitpicking in its syntax. In short, most end users, particularly the 'naive' (in computing terms) business user at whom the machine is aimed, would be frightened silly by it.

But it not intended that the end user should have to grapple with the utilities directly. The facilities exist for the programmer, using the very powerful utilities, to insulate the user from the operating system completely — the user would buy his Monroe with the software already arranged so that he would never actually have to come face to face with MOS; the auto start, run, load and other utilities can be combined to allow the user to carry out any operation necessary, including disk formatting, housekeeping and full multitasking without needing to learn anything of MOS at all. Although it is possible to insulate the user to some extent from CP/M, software houses rarely seem to bother and, in any case, CP/M simply doesn't allow the same degree of insulation.

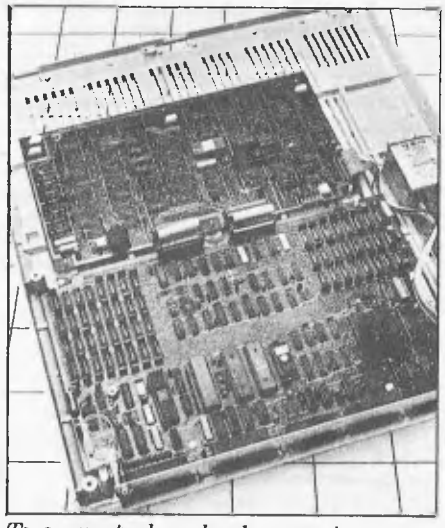
The above answers the question that immediately formed in my mind when I first looked at MOS: why did Monroe go to the trouble and expense of writing its own operating system when there are several off-the-shelf systems already around, such as MP/M-II and Unix? The answer, at least in part, must be that no existing operating system for micros allows the programmer to provide such a high degree of insulation. I feel that Monroe made the right decision in going the lone route. It has decided that it wants to sell microcomputers to businessmen and it has realised that these customers have neither the time not the inclination to learn the vocabulary, concepts and procedures of computing: to these users, the desk-top computer is another piece of office machinery and it needs to be as easy to use as a photocopier. Provided the programmer realises this and takes advantage of the machine's many powerful facilities, it should be easier to achieve this with the Monroe than with most other micros.

From the programmer's point of view, I feel the machine will prove an exciting and challenging beast. Programmers weaned on — or at least thoroughly accustomed to — CP/M will find it strange indeed, but those coming fresh from the mini/mainframe world will find it easy to live with. Which brings us to Monroe's other reason for developing its own operating system: although the official line is to deny it, there are strong and well-informed rumours that the company is developing a minicomputer; it seems reasonable to suggest, then, that MOS will have a good degree of compatibility with the mini's operating system and I'd go so far as to suggest that they were developed by the same team — MOS just has a mini feeling to it.

One minor gripe; Monroe has provided eight programmable function keys (actually 16 as they can be shifted), yet MOS makes absolutely no use of these at all. I understand a future release will, hopefully in the style of Hewlett-Packard's softkeys.



Rear view



Two neat boards house the major electronics.

Monroe Basic

Although Pascal is mentioned as an option in the literature, Monroe Basic is the system's main language. As 'MBasic' has already been used by somebody else, Monroe calls its Basic 'MEBasic' and it's certainly a very comprehensive and powerful implementation of the language.

Basic is called up by typing 'Basic' followed by the amount of memory you want to allocate to it; typing 'Basic,, 34000' gives you Basic (which takes up 34k) plus another 34k to play with. If you don't allocate any memory, the system gives you the default value of just 5 kbytes.

I found MEBasic one of the easiest and most pleasant to use of the various Basics knocking around these days. During programming and in command mode it accepts input in either upper

MONROE 8820

programming, these are converted and stored in upper case, so that 'a' and 'A', if used as variable names, reference the same variable and both appear as 'A' when the program is listed.

MEBasic checks your syntax dynamically as soon as you hit return at the end of the line. If you make a mistake, it consults an 8 kbyte disk file of error messages and tells you what's wrong; if the file isn't present on the current disk it gives you an error code instead. If you've made an error, the machine also bleeps at you and automatically enters its editing mode, with the cursor positioned at the end of the offending line — you can't continue until you've corrected the mistake, and editing keys such as insert and delete are provided to make this very easy. Thus, once you've typed in your program, you *know* that it's at least free of syntax errors before you RUN it.

On entering MEBasic, you are allowed variable names of only one letter plus (optionally) one digit, ie, A-Z and A0-Z9. Typing EXTEND (or including it in a program) allows the use of variable names of up to 32 characters, all of which are significant. I would have preferred the EXTEND mode to be the default mode, thus encouraging more readable programming; there's also a NO EXTEND command which cancels the EXTEND mode. You need to exercise a little caution when using EXTEND, though: in the NO EXTEND mode the system, is indifferent to spaces, so that INPUTA: PRINTA will be accepted. Using EXTEND, though, makes spaces critical as INPUTA would be interpreted as a variable name, and, in this context, cause an error message.

As can be seen from the list of Basic reserved words, MEBasic contains as its core the 'standard' facilities found in most Basics and takes a standard syntax for these, thus making it easy to use for programmers coming from, say, Microsoft Basic. In addition, there's a vast range of facilities to delight the serious programmer and to make the writing of business applications packages a cinch.

Of greatest interest among these are the ISAM file-handling capabilities. Regrettably, time did not allow me to explore these as thoroughly as I would have liked, but, basically, they allow you to open, read, update and write ISAM files which you create with a special Basic program, the listing of which is in the MEBasic manual. I know of no other microcomputer Basic which incorporates ISAM handling; it's very powerful and very useful.

Scanning through the reserved words list, here's a rundown of those which are peculiar to MEBasic and whose use isn't immediately obvious.

ADD$: adds the value of two strings of numbers to a specified number of decimal places. SUB$, DIV$, and MUL$ similarly subtract, divide and multiply strings.

CLEAR: clears all variables and closes any files which happen to be open.

COMMON: allows you to share variables and their values between programs which are CHAINed.

COMP%: compares two numeric strings, A$ and B$, returning -1 if A$ < B$, 0 if they're equal and 1 if A$ > B$.

CVT: converts numeric values into ASCII for an I/O file.

FLSH: causes the string following it to flash when printed on the screen.

OCT$: converts a decimal value into an octal one. Similarly, HEX$ converts to hex.

OPTION BASE: Allows you to save memory space when using arrays; normally, DIM A (5) would give an array of *six* elements A(0) to A(5); OPTION BASE 1 would eliminate the default A(0) element to give an array of five elements.

PDL: returns the x or y coordinates of a joystick. As joysticks aren't provided with the OC 8820, I assume this is for use with the educational micro.

POSIT: Positions the file pointer to the specified number of bytes from the start of the file.

SET TIME: like the Time utility, this lets you set the internal calendar/clock.

SLEEP: Wins my 'Basic Reserved Word of the Year' award for 1982. It does just what it says by suspending the current program for a specified time (in seconds).

MEBasic has been designed not only for the OC 8820 but also for the educational computer with its high resolution colour graphics. Thus, in addition to the listed functions there is a whole range more dealing with colour graphics; as these obviously don't work on the OC 8820, I haven't included them in the list of reserved words.

As can be seen from this very quick look at MEBasic, it's a powerful language, thoughtfully designed and implemented and easy and friendly to use. Programmers will find it an efficient Basic as it not only encourages good documentation through the use of EXTENDed variable names but has many powerful built-in features, too, including the ability to CALL the operating system's supervisor calls directly. With the system came a large number of various Basic programs, some of them utilities and others just games and demonstrations; all are thoroughly documented and most are designed to show you how to use various features of both language and machine.

Documentation

The system came with three bulky manuals, one on MOS, one on the utility programs and a third, *very* thick one, on MEBasic. They were all described as programmer's reference manuals and a warning inside pointed out that they had been designed for experienced programmers, not as tutorials. Fair enough, they certainly made no attempt to teach basic concepts but they all explained every feature of operating system, utilities and Basic very thoroughly. I'd go so far as to say that they're among the best examples of documentation I've seen, being clearly written, thoroughly and accurately indexed and including heavily-commented examples of each feature, leaving the reader in no doubt whatsoever of how each facility should be used.

No hardware manuals were supplied with the machine, the only hardware information being a single-sheet sales leaflet with a summary of the system's specifications.

Basic reserved words

ABS	FNEND	PDL
ADD$	FOR..NEXT..STEP	PEEK
ASCII		PEEK2
ATN	GET	PI
AUTO	GOSUB	POKE
	GOTO	POSIT
BYE		PREPARE
	HEX$	PRINT
CALL		PRINT USING
CHAIN	IF..THEN..ELSE	PUT
CHR$	INP	
CLEAR	INPUT	RANDOMIZE
CLOSE	INPUT LINE	READ
COMMON	INSTR	REM
COMP%	INT	RENUMBER
CONTINUE	INTEGER	RESTORE
COS	ISAM OPEN	RESUME
CUR	ISAM READ	RETURN
CVT	ISAM UPDATE	RIGHT$
CVT$F	ISAM WRITE	RND
CVTF$		RUN
	KILL	
DATA		SAVE
DBLE	LET	SCR
DEF	LIST	SET TIME
DIM	LOAD	SGN
DIV$	LOG	SIN
DOUBLE	LOG10	SINGLE
		SLEEP
EDIT	MERG$	SOUND
END	MID$	SPACE$
ERASE	MOD	SQR
ERRCODE	MUL$	STDY
EXP		STOP
EXTEND	NAME	STRING$
	NEW	SUB$
FGCIRCLE	NO EXTEND	SVC
FGCOPY	NOTRACE	SWAP
FGCTL	NRML	SYS( )
FGDRAW	NUM$	
FGERASE		TAN
FGFILL	OCT$	TIME$
FGLINE	ON ERROR GOTO	TRACE
FGPAINT	ON..GOSUB	
FGPOINT	ON..GOTO	UNSAVE
FGPUT	ON..RESTORE	
FGROT	ON..RESUME	VAL
FGSCALE	OPEN	VAROOT
FIX	OPTION BASE	VARPTR
FLOAT	OPTION EUROPE	
FLSH	OUT	WHILE..WEND
FN		

Expansion

Although not officially announced yet, it seems probable that the memory will be expandable to beyond 128k, although by how much and whether this will be an internal expansion or an add-on box just isn't known yet.

Hard disks are on their way, either 5 or 10 Mbytes as an external unit with a built-in tape drive for back-up. Monroe feels this is preferable to the conventional approach of replacing one of the floppies with a winchester drive and backing up onto a series of floppies, although many users seem happy with the latter approach.

Monroe is shortly to announce another system, a visible ledger machine with either 32 or 64 kbytes of RAM and a 100k cassette tapes store which can hold either programs or data. This will link up to the OC 8820 through the latter's communications port for bi-directional data transfer and will have its own keyboard, 40-character strip display and integral printer which, apart from printing the ledger cards, will act as a general purpose printer too. It's an interesting idea — there are lots of people around who feel uneasy at trusting their business records entirely to disk or tape and who would like to combine computing with more traditional methods. Anticipated selling price of the visible ledger system is around $3000.

I mentioned earlier that Monroe is thought to be working on a mini; if and when this appears, the OC 8820 should be able to communicate with it and communication with other OC 8820s will be possible — it's a software requirement not a hardware upgrade.

Conclusions

The Monroe OC 8820 is a well-built micro which makes no pretensions at being other than a no-nonsense business tool. It places the onus firmly on the programmer/software house to provide the user with a friendly, easy-to-use

MONROE 8820

system tailored to his/her specific requirements, but all the facilities to do this are provided.

At just under $5500 for the basic system, it's definitely an up-market micro these days, especially considering that it's an 8-bit machine at heart. But the power and flexibility of its operating system compensates for the price and its quality construction equals that of Hewlett-Packard's HP 125, although, in a very definite swings-and-roundabouts comparison, it hasn't some of the HP 125's attractive features.

I disliked the Monroe at first and I feel that others, especially the programmer used to CP/M, may feel the same. But on getting to know it, and on investigating the philosophy behind it, I found it a powerful and pleasant micro aimed at a specific niche in the market, for which it is well suited.

Ultimately, though, the machine's future will depend on the degree to which its applications software is tailored to it.

Technical specifications

Processor:	Z80A, 3MHz
Memory:	128k user RAM, 4k video RAM, 2k bootstrap PROM
Disks:	Twin single-sided, double density, 320k each.
Screen:	80x24 amber on grey, double height, double width, dimmed, flashing, lo-res graphics.
I/O:	3xRS232 ports, expansion port, ext disk port.
Keyboard:	93 keys inc full qwerty, numeric pad, cursor controls, 8 prog function keys, screen editing keys.
System software:	Monroe operating system; CP/M (opt)
Languages:	Monroe Basic, Pascal

Benchmark timings

BM1	2.1
BM2	4.2
BM3	9.9
BM4	10.5
BM5	11.0
BM6	20.1
BM7	32.0
BM8	33.0

All timings in seconds. For a full listing of the Benchmark programs, see APC Vol 1 No 8.

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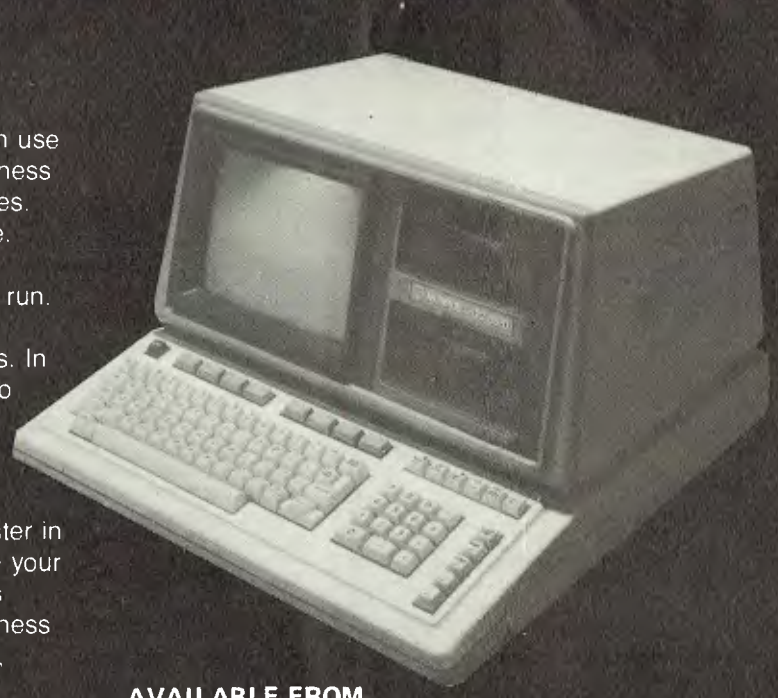

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Make sure your programs are fully debugged before you send them in on cassette (although we will accept disks) with a clear listing on plain paper. Documentation would be welcome, and if you want it returned please label everything with your name and address and include an SAE. Send contributions to APC Programs, 462 Burwood Road, Hawthorn, Vic. 3122.

ZX81 Hypocycloids

by R Clark

Several readers have written in to ask for more programs for the 1k ZX81. As I've received so many letters about it here is a 1k program which will draw circular patterns on the screen. There is room in this type of program for experimentation and it is useful for demonstrating to beginners how to use the PLOT command in conjunction with functions like SIN and COS.

When the computer requests input all that is required are three numbers, the variables A, N and R. The pattern will vary according to the numbers you assign to these variables.

```
10 INPUT A
20 INPUT N
30 INPUT R
35 REM N*A+R<31, N*A-R<21
40 FOR T=0 TO 2*PI STEP PI/50
50 LET X=INT(0.5+N*A*COS(T+R)*COS(T+N))
60 LET Y=INT(0.5+N*A*SIN(T-R)*SIN(T+N))
70 PLOT 31+X,22+Y
80 NEXT T
```

TRS-80 Truth

by Mike Costello

This is a single-player game of reasoning in which the player tries to crack a secret rule set at the start by the computer. It is played using a standard card deck but is otherwise unlike a normal card game.

The player's hand consists of the full deck, which is played one card at a time. If a card is in accordance with the computer's rule it is put in a part of the screen reserved for correct plays. If it is not, it is put in the part of the screen reserved for wrong cards. Guessing the rule is indicated by playing eight correct cards in succession, after which a score is given between 0 and 100%. This is based on the number of cards left in the pack and the number of mistakes made.

To play a card, type S,H,D or C for the suit and A,K,Q,J or 2-10 for the rank. A full stop enters the play and backspacing or pressing 'enter' will erase it. Truth will run in 14k on a TRS-80 Model 1 Level 2.

```
10 CLEAR2000:DEFINTA-C,E-M:DEFSTRN-Z:DIMP(13,3):H(13,3):PC(51):PM(51):J(12),MC(
12):JW(3):ML=3:C=949:RANDOM
20 GOSUB30010
30 CT=52:FORA=0TO3:P(1,A)=" A":P(11,A)=" J":P(12,A)=" Q":P(13,A)=" K":FORB=2TO10
:P(B,A)=STR$(B):NEXT:NEXT'PLAYERS HAND/STRINGS
40 FORA=0TO3:FORB=1TO13:H(B,A)=B:NEXT:NEXT'PLAYERS HAND/NUMBERS
110 CLS:PRINTCHR$(23):PRINT@144,"T  R  U  T  H":PRINT@204,"©1981 M W COSTELLO";G
OSUB54100:A=FRE(Z):PRINT@448,"PLEASE CHOOSE YOUR";PRINT"LEVEL OF PLAY:";PRINT@58
4,"1.  "U1:PRINT@648,"2.  "U2:PRINT@712,"3.  "U3:PRINT@896,"TYPE 1, 2 OR 3"
120 GOSUB10010
130 IFZ="1"THENUS=U1:GOSUB5100ELSEIFZ="2"THENUS=U2:GOSUB6410ELSEIFZ="3"THENUS=U3
:GOSUB6803ELSE120
140 'COME BACK HERE WITH CHOSEN RULE (=HAVE VALUES OF S1-4 & GC)
1010 CLS:GOSUB11010:GOSUB11110:CC=64:CM=320:C5=0:C6=0:K=0
1090 ML=3:C=949:GOSUB50000
1092 IFZ="Z"THENGOTO 64020ELSEGOSUB 17010:IFCJUNK =1THENGOTO1090ELSEGOSUB 3012
1095 IFCT=0THENGOTO 13010.ELSEIFK=8THENGOTO 30010.ELSEFORA=0TO2:JW(A)=JW(A+1):NE
XT:JW(3)=JT:GOTO1090'RECORD OF RIGHT/WRONG LAST 4
1100 'FOLLOWING ARE ALL SUBROUTINES
3012 IFCT=52THENE=1:GOTO3020'FIRST CARD ALWAYS RIGHT
3015 ONGOGOSUB8020,8040,8060,8110,8130,8160,8210,8240,8270,8290,8310,8360,8380,8
410,8440,8450,8460,8470,8500,8510,8520,8530,8540,8550
3020 IFE=1GOSUB 12010, ELSEGOSUB 12105
3030 CT=CT-1:IFCT=0THENGOTO13010.ELSERETURN
5100 GOSUB6910
5400 GC=RND(8):ONGCGOSUB5500,5510,5520,5530,5540,5550,5560,5570'8 BRANCHES
5410 RETURN
5500 S1=X3:S2=XA:S3=V5:S4=V1:S5="":S6="":RETURN
```

PROGRAMS

```
5510 S1=X4:S2=V1:S3=X5:S4=V7:RETURN
5520 L=RND(13):N=P(L,0):L1=L+6:IFL1<14THENNS=P(L1,0)ELSENS=P(L1-13,0):L1=L1-13
5521 IFL1=13THENQ=P(1,0)ELSEQ=P(L1+1,0)
5522 L2=L1+6:IFL2<14THENQS=P(L2,0)ELSEQS=P(L2-13,0):L2=L2-13
5523 S1=N+" TO "+NS:S2=V1:S3=Q+" TO "+QS:S4=V7
5524 FORA=0TO12:J1(A)=0:J2(A)=0:NEXT:FORA=0TO6:J1(A)=L:L=L+1:IFL=14THENL=1
5525 NEXT:FORA=0TO5:J2(A)=L:L=L+1:IFL=14THENL=1
5526 NEXT:RETURN
5530 S1=X3:S2=V3:S3=XC+XD:S4=Y7+" "+Y5+" '+Y4+" "+Y6+" "+Y7+" ....":RETURN
5540 S1=X3:S2=X3:S3=XC:S4=XD:S5=XE+" (FIRST 2 ALWAYS RIGHT)":RETURN
5550 S1=X3:S2=X6:S3=V8:S4=X8:S5=V1:RETURN
5560 S1=X3:S2=X6:S3=V8:S4=X7:S5=V1:RETURN
5570 S1=X2:S2=XF:S3=XG:RETURN
6410 GOSUB6910:GC=RND(10):ONGCGOSUB6420,6430,6440,6450,6460,6470,6480,6490,6500,
6510
6415 GC=GC+8:RETURN
6420 S1=X3:S2=X3:S3=XC:S4=XD:S5="Y5+" "+Y7+" "+Y4+" '+Y6+" '+Y5+" ....":RETURN
6430 S1=X6:S2=X6:S3=XH:RETURN
6440 S1=V3:S2="IT":S3=XC:S4="THIS RULE:
DIVIDE "+V1+" BY 4. IF REMAINDER = 3 PLAY "+Y7+". IF = 2 PLAY "+Y6+", IF = 1 PLA
Y "+Y5+". ELSE PLAY "+Y4:RETURN
6450 S1=X2:S2=V1:S3=X4:S4=" AND "+X1+" IS CORRECT IF "+V1+" IS "+X5:RETURN
6460 S1=X3:S2=X6:S3="4 TO 6":S4=X8:S5=V1:RETURN
6470 S1=X3:S2=X6:S3="8 TO 10":S4=X7:S5=V1:RETURN
6480 S1=X3:S2=V3+" OR "+X6:S3=V4:S4=V1:RETURN
6490 L5=RND(4)-1:L6=L5:GOSUB6495:L7=L5:GOSUB6495:L8=L5:GOSUB6495:L9=L5:L5=L6:GOS
UB6497:T6=T5:L5=L7:GOSUB6497:T7=T5:L5=L8:GOSUB6497:T8=T5:L5=L9:GOSUB6497:T9=T5:G
OTO6499
6495 L5=L5+1:IFL5>3THENL5=0
6496 RETURN
6497 IFL5=0THENT5=Y4ELSEIFL5=1THENT5=Y5ELSEIFL5=2THENT5=Y6ELSEIFL5=3THENT5=Y7ELS
EPRINT"BUG":STOP
6498 RETURN
6499 S1=X4+" "+X6:S2=V1:S3=T6+" OR "+T7+" AND ":S4=X5+" "+X6+" IS CORRECT IF
"+V1+" IS "+T8+" OR "+T9:RETURN
6500 S1=X1:S2=XF:S3=XG:S4=" ":S5="":S6=X2:S7=XF:S8=Y1:RETURN
6510 S1=X3:S2=X6:S3="WITHIN RANGE 2 LESS TO 2 MORE THAN "+V1:RETURN
6803 GOSUB6910:GC=RND(6):ONGCGOSUB6810,6820,6830,6840,6850,6860
6806 GC=GC+18:RETURN
6810 S1=X4:S2=V1:S3="SAME "+XA+" AS":S4=V2+" ONE":S5="":S6=X5:S7=V1:S8="DIFFEREN
T "+XA+" FROM":S9=V2+" ONE":RETURN
6820 S1="A TO ?":S2=V2+" 2":S3=X1:S4="":S5="":S6="B TO K":S7=V2+" 2":S8=X2:RETUR
N
6830 S1=X4:S2=XF+" BUT 3":S3=Y1:S4="":S5="":S6=X5:S7=S2:S8=XG:RETURN
6840 S1="EVERY THIRD CARD":S2="IT":S3=XC+XD:S4=Y5+" "+Y4+" "+Y7+" "+Y6:S5="(OTHE
R CARDS ARE ALWAYS CORRECT)":RETURN
6850 S1="COURT "+X3:S2=V1:S3="NOT "+S1:S4=V7:RETURN
6860 S1=X2:S2=V6+Y2:S3=X8+" OR EQUAL TO":S4=V6+V1+" CARDS":S5="":S6=X1:S7=S4:S8=
X8:S9=S2:RETURN
6910 S1="":S2="":S3="":S4="":S5="":S6="":S7="":S8="":S9="":RETURN
7000 RETURN
8020 IF(F=0ORF=3)AND(HS=1ORHS=2)THENE=1ELSEIF(F=1ORF=2)AND(HS=0ORHS=3)THENE=1ELS
EE=0
8030 RETURN
8040 L=1:IFG=(LORG)IFHD<>(LORHD)THENE=1ELSEE=0ELSEIFHD=(LORHD)THENE=1ELSEE=0
8050 RETURN
8060 E=0:FORA=0TO12:IFJ1(A)=GTHEN 8070 ELSENEXT:GOTO 8080
8070 FORA=0TO12:IFJ2(A)=HDTHENE=1:GOTO 8100 ELSENEXT:GOTO 8100 'WITH E LEFT AS 0
8080 FORA=0TO12:IFJ2(A)=GTHEN 8090 ELSENEXT
8090 FORA=0TO12:IFJ1(A)=HDTHENE=1:GOTO 8100 ELSENEXT:GOTO 8100 'WITH E AS 0
8100 RETURN
8110 IF(F=3ANDHS=1)OR(F=1ANDHS=0)OR(F=0ANDHS=2)OR(F=2ANDHS=3)THENE=1ELSEE=0
8120 RETURN
8130 IFCT=51THENE=1:RETURNELSEL=1:IFHD=(LORHD)THENLC=0ELSELC=1
8140 IFG=(LORG)THENLF=0ELSELF=1'LF=D E N O M  OF LAST CORRECT
8150 IFG0=(G0ORL)THENL0=0ELSEL0=1
8160 IF(LC=1ANDLF=0ANDL0=0)OR(LC=1ANDLF=1ANDL0=0)OR(LC=0ANDLF=1ANDL0=1)OR(LC=0AN
DLF=0ANDL0=1)THENE=1ELSEE=0
8170 RETURN
8180 IFG=13THENGT=0ELSEGT=G
8190 E=0:FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=GT+1:GT=GT+1:IFGT=13THENGT=0
8200 NEXT:FORA=0TO2:IFJ1(A)=HDTHENE=1:RETURNELSENEXT:RETURN'WITH E = 0
8210 IFG=1THENGT=14ELSEGT=G
8220 E=0:FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=GT-1:GT=GT-1:IFGT=1THENGT=14
8230 NEXT:FORA=0TO2:IFJ1(A)=HDTHENE=1:RETURNELSENEXT:RETURN'JUST LIKE 25060
8240 E=0:IFHS=0ORHS=3THENE=1:RETURNELSEIFJV(3)=1THENE=1:RETURNELSERETURN'WITH E
=0 BECAUSE CARD RED BUT LAST PLAYED WAS CORRECT
8265 'END OF LEVEL1 - NOW LEVEL2 TESTS
8270 E=0:IF(F=1ANDHS=3)THENE=1ELSEIF(F=3ANDHS=0)THENE=1ELSEIF(F=0ANDHS=2)THENE=1
ELSEIF(F=2ANDHS=1)THENE=1
8280 RETURN
8290 FORA=0TO12:J1(A)=0:NEXT:FORA=0TO2:J1(A)=A+1:NEXT:J1(3)=5:J1(4)=7:J1(5)=11:J
1(6)=13
8300 FORA=0TO6:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8310 IF(G=6ORG=10)AND(HS=2)THENE=1:RETURN
8320 IF(G=5ORG=9ORG=13)AND(HS=1)THENE=1:RETURN
8330 IF(G=7ORG=11)AND(HS=3)THENE=1:RETURN
8340 IF(G<5ORG=8ORG=12)AND(HS=0)THENE=1:RETURN
8350 E=0:RETURN
8360 L=1:IFG=(GORL)THENL5=1ELSEL5=0
8370 IF(HS=1ORHS=2)AND(L5=0)THENE=1:RETURNELSEIF(HS=0ORHS=3)AND(L5=1)THENE=1:RET
URNELSEE=0:RETURN
8380 FORA=0TO12:J1(A)=0:NEXT:L1=G+4:IFL1>13THENL1=L1-13
8390 FORA=0TO2:J1(A)=L1:L1=L1+1:IFL1>13THENL1=1
8400 NEXT:FORA=0TO2:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8410 FORA=0TO12:J1(A)=0:NEXT:L1=G-8:IFL1<1THENL1=L1+13
8420 FORA=0TO2:J1(A)=L1:L1=L1-1:IFL1<1THENL1=13
8430 NEXT:FORA=0TO2:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8440 IF(HS=FORHD=G)THENE=1:RETURNELSEE=0:RETURN
8450 L=1:IFHD=(LORHD)THENL=0
8452 IF(L=0ANDF=L8)OR(L=0ANDF=L9)THENE=1:RETURNELSEIF(L=1ANDF=L6)OR(L=1ANDF=L7)T
HENE=1:RETURNELSEE=0:RETURN
8460 IF(HS=0ORHS=3)AND(JV(3)=1THENE=1:RETURNELSEIF(HS=1ORHS=2)AND(JV(3)=2THENE=1:R
ETURNELSEE=0:RETURN
8470 FORA=0TO12:J1(A)=0:NEXT:L1=G-2:FORA=0TO4:IFL1<1THENL1=L1+13
8472 J1(A)=L1:L1=L1+1:IFL1>13THENL1=1
8474 NEXT:FORA=0TO4:IFHD=J1(A)THENE=1:RETURNELSENEXT:E=0:RETURN
8490 'END LEVEL2 - NOW LEVEL3 TESTS
8500 IFCT>50THENE=1:RETURNELSEL=1:IF(F=0ORF=3)AND(F0=0ORF0=3)THENIFHD<>(LORHD)TH
ENE=1:RETURN
8502 IF(F=1ORF=2)AND(F0=1ORF0=2)THENIFHD<>(LORHD)THENE=1:RETURN
8504 IF(F=0ORF=3)AND(F0=1ORF0=2)THENIFHD=(LORHD)THENE=1:RETURN
8506 IF(F=1ORF=2)AND(F0=0ORF0=3)THENIFHD=(LORHD)THENE=1:RETURN
8508 E=0:RETURN
8510 IFCT>49THENE=1:RETURNELSEIF(F1=0ORF1=3)AND(HD<8)THENE=1:RETURNELSEIF(F1=1OR
F1=2)ANDHD>7THENE=1:RETURNELSEE=0:RETURN
8520 IFCT>48THENE=1:RETURNELSEL=1:IFHD=(LORHD)ANDJV(0)=1THENE=1:RETURNELSEIFHD<>
(LORHD)ANDJV(0)=2THENE=1:RETURNELSEE=0:RETURN
8530 E=1:IFCT>49THENRETURNELSEDL=C5/3:IFDL<>INT(DL)THENRETURN
```


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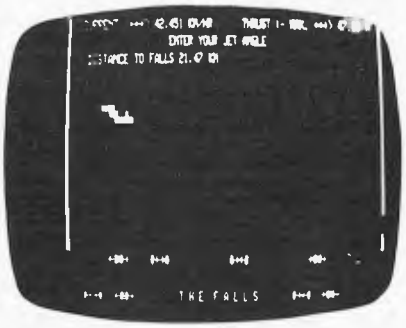

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CLEAR...C	CLOAD...X	CLS.....U	CONT....F	CSAVE...K
CSAVE...W	DATA....D	DEFINT...W	DEFINT...I	DEFSNG..K
DEFSTR..XP	DELETE..XD	EDIT....E	ERROR....X	FOR.....F
GOSUB...H	GOTO....G	INKEY$..K	INPUT....I	LEFT$...L
LIST....L	MID$....M	MERGE...M	NEXT....M	NEXT....P
POINT...X2	POKE....O	RANDOM..W	READ....R	RESET...X
RESTORE..XQ	RESUME..XU	RETURN..J	RIGHT$..Y	RND.....Y
RUN.....R	SET.....E	STEP....D	STOP....XG	STRING$.S
STR$....Z	SYSTEM..XS	TAB(....T	TROFF....T	TRON....T
		USING...U	WAIT?R..V	

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PROGRAMS

```
8532 IFHS=@ANDF1=1THENRETURNELSEIFHS=3ANDF1=0THENRETURNELSEIFHS=2ANDF1=3THENRETU
RNELSEIFHS=1ANDF1=2THENRETURNELSEE=0:RETURN
8540 IFHD>10ANDG<11THENE=1:RETURNELSEIFHD<11ANDG>10THENE=1:RETURNELSEE=0:RETURN
8550 IFC6>=C5AND(HS=1ORHS=2)THENE=1:RETURNELSEIFC6<C5AND(HS=0ORHS=3)THENE=1:RETU
RNELSEE=0:RETURN
10010 Z=INKEY$:IFZ=""THEN10010ELSERETURN
11010 PRINTY1:PRINT@256,Y2:PRINT@512,Y3:PRINT@576,Y4:PRINT@608,Y5:PRINT@704,Y6:P
RINT@736,Y7:PRINT@896,Y8:PRINTY9:RETURN
11110 PRINT@640,"";:FORA=1TO13:PRINTP(A,0);:NEXT:PRINT@672,"";:FORA=1TO13:PRINTP
(A,1);:NEXT:PRINT@768,"";:FORA=1TO13:PRINTP(A,2);:NEXT:PRINT@800,"";:FORA=1TO13:
PRINTP(A,3);:NEXT:RETURN
11210 PRINT@64,"";:FORA=@TO51:PRINTPC(A)" ";:NEXT
11220 RETURN
11310 PRINT@320,"";:FORA=@TO51:PRINTPM(A);" ";:NEXT
11320 RETURN
11410 GOSUB11110'IN FACT DRAWS ACTUAL HAND
11420 RETURN
12010 IFCT<52THENPRINT@844,VM;"CORRECT  ****";:GOSUB65310:PRINT@844,CHR$(30);:GO
SUB65310:PRINT@844,VM;"CORRECT  ****";:GOSUB65310:PRINT@844,CHR$(30)
12020 GOSUB12200:PRINT@CC,Q5;:ZT=P(HD,HS):PRINTRIGHT$(ZT,(LEN(ZT)-1));:IFPOS(@)>>
60THENCI=7ELSEIFHD=10THENCI=4ELSECI=3
12030 CC=CC+CI:GOSUB12250:PRINT@C,CHR$(224);:PRINT@C,"";:ZZ=P(HD,HS):ZT=RIGHT$(Z
Z,LEN(ZZ)-1):P(HD,HS)="":FORA=1TO13:PRINTP(A,HS));:NEXT
12040 GOSUB12200:PC(C5)=Q5+ZT:C5=C5+1
12050 F3=F2:G3=G2:F2=F1:G2=G1:F1=F@:G1=G@:F@=F:G@=G
12055 F=HS:G=HD
12060 JT=2:IFCT=52THENRETURNELSEK=K+1:RETURN
12105 PRINT@844,VM;"A MISTAKE  ****";:GOSUB65310:PRINT@844,CHR$(30);:GOSUB65310:
PRINT@844,VM;"A MISTAKE  ****";:GOSUB65310:PRINT@844,CHR$(30);
12110 GOSUB12200:PRINT@CM,Q5;:ZT=P(HD,HS):PRINTRIGHT$(ZT,(LEN(ZT)-1));:IFPOS(@)>>
60THENCI=7ELSEIFHD=10THENCI=4ELSECI=3
12120 CM=CM+CI:GOSUB12250:PRINT@C,CHR$(224);:PRINT@C,"";:ZZ=P(HD,HS):ZT=RIGHT$(Z
Z,LEN(ZZ)-1):P(HD,HS)="":FORA=1TO13:PRINTP(A,HS));:NEXT
12130 GOSUB12200:PM(C6)=Q5+ZT:C6=C6+1
12140 K=@:JT=1:RETURN
12200 IFHS=@THENQ5="S"ELSEIFHS=1THENQ5="H"ELSEIFHS=2THENQ5="D"ELSEQ5="C"
12210 RETURN
12250 IFHS<2THENC=640+HS*32ELSEC=704+HS*32
12255 RETURN
13010 CLS:PRINT"SORRY, YOU HAVE NOW PLAYED ALL YOUR CARDS AND WE MUST REVEAL THE
RULE:"
13020 GOSUB40010:GOTO40030
17010 CJ=@
17505 Z=LEFT$(ZW,1):IFZ="S"ORZ="H"ORZ="D"ORZ="C"THEN17507ELSE 17700
17507 IFZ="S"THENHS=@ELSEIFZ="H"THENHS=1ELSEIFZ="D"THENHS=2ELSEHS=3
17509 Z=MID$(ZW,2,1):IFZ<>"1"THENIFLEN(ZW)=3THEN17700
17510 IFZ="1"THENIFLEN(ZW)<>3THEN 17700 ELSEIFRIGHT$(ZW,1)<>"@"THEN 17700 ELSEIF
Z<>"1"ANDLEN(ZW)=3THEN 17700
17515 IFLEN(ZW)=3THENHD=10ELSEIFZ="A"THENHD=1ELSEIFZ="J"THENHD=11ELSEIFZ="Q"THEN
HD=12ELSEIFZ="K"THENHD=13ELSEHD=VAL(Z):IFHD=@THEN 17700
17535 IFH(HD,HS)=@THEN60090'HE'S NOT HOLDING SUCH A CARD
17545 H(HD,HS)=@:RETURN'SUB TOTAL PLAYER'S CARDS
17700 PRINT@960,CHR$(30);:PRINT@960,"NO SUCH CARD IN THE PACK!";:GOSUB65010:CJUN
K=1:PRINT@960,CHR$(30);:PRINT@960,Y9;:RETURN
20010 Y1="CORRECT":Y2="MISTAKES":Y3="YOUR HAND":Y4="SPADES":Y5="HEARTS":Y6="DIAM
ONDS":Y7="CLUBS":Y8="GIVE SUIT AND DENOMINATION OF CARD YOU WANT TO PLAY:":Y9="I
F YOU DECIDE TO GIVE UP, TYPE:  Z
20020 X1="BLACK":X2="RED":X3="CARD":X4="EVEN":X5="ODD":X6="DENOMINATION":X7=" LE
SS THAN":X8=" GREATER THAN":V1=" LAST CORRECT CARD":V2=V1+" BUT":V3="SUIT":V4="
SAME AS ":V5="DIFFERENT FROM":V6=" TOTAL OF ":V7=" AND VICE VERSA"
20030 VM="****  THAT DISCARD IS ":V8="1 TO 3":U1="BASIC":U2="INTERMEDIATE":U3="A
DVANCED
20040 XA=" COLOUR":XB="IT FOLLOWS THE SEQUENCE":XC="CONSISTENT WITH ":XD="SEQUENC
E OF: ":XE="2 ODD ALTERNATING WITH 2 EVEN":XF="PREVIOUS PLAY":XG="MISTAKE":XH="P
RIME NUMBER"
21000 RETURN
30010 A=FRE(Z):CLS:PRINT"WELL DONE! WITH 8 CORRECT DISCARDS IN A ROW, YOU HAVE W
ORKED OUTTHE SECRET RULE (UNLESS YOU'RE JUST LUCKY). THE RULE IS:
30020 GOSUB40010:GOSUB41003:GOTO40030
40010 PRINT@192,S1" IS CORRECT ONLY IF":PRINTS2:PRINT" IS "S3;S4:PRINTS5
40020 IFS6>""THENPRINT@448,"AND":PRINTS6" IS CORRECT ONLY IF "S7" IS":PRINTS8;S9
40025 RETURN
40030 PRINT@902,"FOR ANOTHER GAME TYPE:  G":PRINT@966,"TO SEE THE DISPLAY OF CAR
DS TYPE:  D";
40040 GOSUB10010:IFZ="G"THENGOTO30ELSEIFZ="D"THENCLS:GOSUB11010:PRINT@896,"FOR A
NOTHER GAME TYPE: G  TO SEE THE RULE AGAIN TYPE: R";:PRINT@960,CHR$(30);:GOSUB1
1210:GOSUB11310:GOSUB11410ELSE40040
40050 GOSUB10010:IFZ="G"THENGOTO30ELSEIFZ<>"R"THEN40050ELSECLS:GOSUB40010
40060 IFK<>8THEN40030ELSEGOSUB41003:GOTO40030
41003 L1=44-C6
41005 D1=CT/43:D2=L1/44:D3=(D1+D2)*50
41010 PRINT@729,"S C O R E":PRINT"CARDS IN HAND =  "CT;:PRINT@800,"MISTAKES =  "
C6;PRINTUSING"FINAL SCORE:     ###.##%";D3;:PRINT@964,"("U$" GAME)
41020 RETURN
50000 PRINT@C,CHR$(30);:PRINT@C,"";:PRINTCHR$(14);
50010 ZW=""
50020 Z="":GOSUB10010
50030 IFZ="Z"THENPRINTCHR$(15);:RETURN
50040 IFZ=","THENPRINTCHR$(15);:RETURNELSEIFZ=CHR$(8)THENIFZW=""THEN50020ELSEZW=
LEFT$(ZW,LEN(ZW)-1)ELSEIFZ=CHR$(13)GOSUB 50070:GOTO50000ELSEIFZ<CHR$(32)THENPRIN
TCHR$(15):GOTO50000ELSEZW=ZW+Z
50050 PRINTCHR$(14);:IFZ="S"THENPRINTY4;" ";ELSEIFZ="H"THENPRINTY5;" ";ELSEIFZ="
D"THENPRINTY6;" ";ELSEIFZ="C"THENPRINTY7;" ";ELSEPRINTZ;
50060 IFLEN(ZW)<=11THEN50020ELSEPRINTCHR$(15):PRINT@960,"YOU'RE TYPING TOO MANY
CHARACTERS":GOSUB65010:PRINT@960,CHR$(30);:PRINT@960,Y9;:GOTO50000
50070 PRINTCHR$(15);:PRINT@960,CHR$(30);:PRINT@960,"TYPE A FULL STOP TO PLAY YOU
R CARD - DON'T HIT ENTER";:GOSUB65010:PRINT@960,CHR$(30);:PRINT@960,Y9;:RETURN
60090 PRINT@960,CHR$(30);:PRINT@960,"YOU'RE NOT HOLDING THAT CARD!";:GOSUB65010:
PRINT@960,CHR$(30);:PRINT@960,Y9;:CJUNK=1:RETURN
64020 CLS:PRINT@256,"IF YOU ARE SURE YOU WANT TO GIVE UP THE ATTEMPT TO GUESS TH
E  SECRET RULE, HIT ENTER TO SEE WHAT THE RULE IS.  OTHERWISE PRESSANY OTHER K
EY TO RETURN TO THE GAME"
64030 GOSUB10010:IFZ=CHR$(13)THENCLS:PRINT@256,"THE SECRET RULE IS:-":GOSUB40010
:GOTO40030ELSECLS:GOSUB11010:GOSUB11210:GOSUB11310:GOSUB11410:GOTO10090
64100 PRINT@512,"EMJEY, 17 LANGBANK AVENUE, WISE PARK, NOTTINGHAM NG5 5BU";:GOSU
B65110:GOSUB65110:RETURN
65010 FORA=1TO750:NEXT:RETURN
65110 FORA=1TO1250:NEXT:RETURN
65210 FORA=1TO500:NEXT:RETURN
65310 FORA=1TO375:NEXT:RETURN
```

PROGRAMS

PET Doc

by Bob Chappell

Doc is an 'Eliza' type program — ie, the computer will strike up a conversation with you. The computer will introduce itself as 'Dr Solace', a psychiatrist who wants to know all your problems and will give replies based on your input. Writing a program like this needs cunning logic if it's not to be become nonsensical. Cramming such logic and a good range of responses into 8k is not an easy task, so it is possible to make rubbish out of a conversation with the 'doctor'.

Doc contains full instructions and will run on any PET.

```
10 REM*DOC*BOB CHAPPELL*14/2/82
20 GOSUB380
30 L$=H$:B$="":PRINT"■D",
40 GETH$:IFH$=""THEN40
50 V=ASC(H$):IFV=13ORV=20ANDB$=""THEN40
60 IFV=13THENPRINT"■":GOTO110
70 PRINTH$;:IFV=20THENB$=LEFT$(B$,LEN(B$)-1):GOTO40
80 IFV=44THENH$=" "
90 IFV<>39THENB$=B$+H$
100 GOTO40
110 H$=B$+" ":L=LEN(H$):IFTI$<"000500"GOTO130
120 PRINT"SORRY,YOUR TIME IS UP.■":K=39:TI$="000000":GOTO240
130 IFL>60THENK=42:GOTO240
140 IFH$=L$THENK=43:GOTO240
150 REM**SPLIT INTO WORDS***
160 FORJ=1TOE:T$(J)="":NEXT:X=0:Z=1:FORJ=1TOL
170 IFMID$(H$,J,1)=" "THENX=X+1:T$(X)=MID$(H$,Z,J-Z):Z=J+1
180 REM**FIND KEYWORD**
190 NEXT:K=41:FORJ1=1TOA:K$=K$(J1):FORJ=1TOX:T$=T$(J)
200 IFK$=T$+T$(J+1)THENK=J1:F=J+2:J=X:J1=A:GOTO220
210 IFK$=T$THENK=J1:F=J+1:J=X:J1=A
220 NEXTJ,J1
230 REM**SELECT REPLY***
240 Z=L(K)+INT(T(K)*RND(0)):IFZ=Z1THEN240
250 REM**CONJUGATE***
260 Z1=Z:R$=R$(Z):IFRIGHT$(R$,1)<>"*"THEN340
270 J$=" ":IFF>XGOTO330
280 FORJ1=FTOX:T$=T$(J1)
290 FORJ=1TOBSTEP2:IFT$=C$(J)THENT$=C$(J+1):J=B:GOTO310
300 IFT$=C$(J+1)THENT$=C$(J):J=B
310 NEXTJ:IFJ1=XANDT$="I"THENT$="ME"
320 J$=J$+T$+" ":NEXTJ1
330 R$=LEFT$(R$,LEN(R$)-1)+J$+"■?
340 LX=LX+3:IFLX>17THENPRINT"■",H$"■":LX=3
350 PRINTR$;:IFZ=1270RZ=128THENH$="":LX=LX+2
360 GOTO30
370 REM**INITIALISE**
380 PRINT"■":POKE59468,12
390 A=40:B=16:C=142:D=43:E=30:LX=7:DIMK$(A),C$(B),R$(C),L(D),T(D),T$(E)
400 FORJ=1TOA:READK$(J):NEXT
410 FORJ=1TOB:READC$(J):NEXT
420 FORJ=1TOC:READR$(J):NEXT
430 FORJ=1TOD:READL(J),T(J):NEXT:TI$="000000":J=RND(-TI)
440 PRINT"■■■HELLO. I AM DR.SOLACE,A CONSULTANT.
450 PRINT"■PLEASE MAKE YOURSELF COMFORTABLE AND
460 PRINT"TELL ME YOUR PROBLEM.":RETURN
470 REM**KEYWORDS******
480 DATAIM,IAM,ICANT,IWONT,IDONT,IWANTA,IWANTTO,IFEEL,CANI,CANTI,CANYOU
490 DATADONTYOU,AREYOU,WHO,HOW,WHAT,WHERE,WHEN,WHY,YOUAPE,YOURE,YOUR,YOU,MY
500 DATASORRY,YES,NO,HATE,LOVE,THINK,DREAM,FRIEND,MONEY,IF,GREAT
510 DATACOMPUTER,FOOD,SHUTUP,GOODBYE,BYE
520 REM**CONJUGATIONS****
530 DATAI,YOU,I'M,YOU'RE,MY,YOUR,AM,ARE,WAS,WERE,I'VE,YOU'VE,MYSELF,YOURSELF
540 DATAME,YOU
550 REM**REPLIES****
560 DATADOES IT WORRY YOU THAT YOU ARE*
570 DATADID YOU THINK I WOULD BE SHOCKED TO HEARTHAT YOU ARE*
580 DATAHOW LONG HAVE YOU BEEN*,DO YOU LIKE BEING*
590 DATAARE YOU ASHAMED THAT YOU ARE*
600 DATAONE NEVER KNOWS UNLESS ONE TRIES,ONE SHOULDN'T GIVE UP
610 DATAHAVE YOU TRIED HARD TO*
620 DATAHOW CAN YOU TELL THAT YOU CAN'T*
630 DATAWHY WON'T YOU*,WHY DO YOU REFUSE TO*,IS IT WISE NOT TO*
640 DATAHAVE YOU ALWAYS DONE SO?,IS THAT WHY YOU WANT MY HELP?
650 DATADO YOU WISH YOU COULD*,WHY DON'T YOU*
660 DATADOES THAT WORRY YOU?,WOULD YOU LIKE TO*
670 DATAWOULD IT BE SO BAD IF YOU DID*
680 DATABUT WHAT IF YOU NEVER GOT A*,WHAT WOULD YOU DO WITH A*
690 DATAWHAT IF I TOLD YOU THAT I OFTEN WANT A*
700 DATACAN YOU SAY WHY YOU WANT TO*,WHEN DO YOU WANT TO*
710 DATAIS IT YOUR MAJOR AMBITION TO*
720 DATAWHAT DO THESE FEELINGS SUGGEST TO YOU?,DO YOU OFTEN FEEL*
730 DATADO YOU ENJOY FEELING*,DESCRIBE WHAT IT IS LIKE TO FEEL*
740 DATADO YOU REALLY WANT TO*,CAN YOU*
750 DATAWHY ARE YOU UNABLE TO*,WOULD IT HELP IF YOU COULD*
760 DATA"WOULD YOU BE SURPRISED TO LEARN THAT I  CAN*"
770 DATADON'T YOU BELIEVE THAT I CAN*,NOT VERY WELL!
780 DATAPERHAPS ONE DAY I MIGHT*,I PREFER NOT TO*,WOULDN'T YOU LIKE TO*
790 DATAWHY ARE YOU CURIOUS TO KNOW IF I AM*,DO YOU THINK I AM*
800 DATA"SUPPOSE I PREFER AT THIS POINT NOT TO  REVEAL IF I AM*"
810 DATADO YOU PREFER TO ASK THE QUESTIONS?,WHY DO YOU ASK THAT?
820 DATAWHAT ANSWER WOULD YOU LIKE TO HEAR?,IS THAT OF INTEREST TO YOU?
830 DATAYOU REALLY WANT TO KNOW?,WOULD YOU CLARIFY THE QUESTION?
840 DATACAN YOU EXPLAIN WHY YOU ASKED THAT?,I WONDER WHAT LIES BEHIND THAT?
850 DATAPERHAPS ONLY IN YOUR IMAGINATION AM I*
860 DATADO YOU FIND IT AMUSING TO THINK I AM*,WHY DO YOU THINK I AM*
870 DATADO YOU WISH YOU WERE*
880 DATAI THINK IT BEST WE TALK ABOUT YOU NOT ME,I PREFER To TALK ABOUT YOU
890 DATAWHY BRING ME INTO IT?,YOU SEEM VERY INTERESTED IN ME
900 DATAARE YOU NOT SUBCONSCIOUSLY REFERRING TO YOURSELF?
910 DATAWHAT IS YOUR INTEREST IN MY*,WHAT ABOUT YOUR OWN*
920 DATAYOU SEEM CURIOUS TO KNOW ABOUT MY*
930 DATAIS THAT RIGHT? YOUR*,REALLY? YOUR*,YOUR*
940 DATAPLEASE DON'T CRY,THATS QUITE ALL RIGHT,WHY SO DEFENSIVE
950 DATAWHY ARE YOU APOLOGISING?,THERES NO NEED TO BE SORRY
960 DATAYOU APPEAR TO BE QUITE CERTAIN ON THAT,YOU SEEM CONVINCED OF THAT
```


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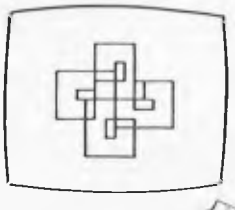

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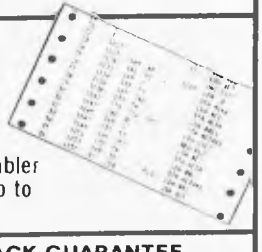

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PROGRAMS

```
970 DATAAREN'T YOU BEING TOO POSITIVE?,WHAT MAKES YOU SAY YES?
980 DATAYOU SEEM VERY CONFIDENT,YOU'RE QUITE SURE?
990 DATAARE YOU SURE?,WOULDN'T YOU LIKE TO THINK ABOUT THAT?
1000 DATAAREN'T YOU BEING A TRIFLE NEGATIVE?,DO YOU MEAN THAT?
1010 DATAWHY NOT?,I THINK YOU REALLY WANTED TO SAY YES
1020 DATAWHY DO YOU DETEST*,IS IT WRONG TO LOATHE*
1030 DATADEEP DOWN DON'T YOU REALLY LOVE*
1040 DATAIS IT WRONG TO LOVE*,HOW REAL IS THIS LOVE FOR*
1050 DATA"ARE YOU SURE THAT IT'S NOT JUST AN      INFATUATION?"
1060 DATAYOU DON'T SEEM SURE*,ONLY THINK*,THINK OR HOPE*,HAVE YOU DOUBTS THAT*
1070 DATAARE YOUR DREAMS FRIGHTENING?,DO YOU DREAM VERY MUCH?
1080 DATAWHAT PEOPLE APPEAR IN YOUR DREAMS?
1090 DATACAN YOU THINK OF A RECURRING DREAM?,WHAT ABOUT NIGHTMARES?
1100 DATAWHAT ARE FRIENDS FOR?,WHY DO SOME PEOPLE HAVE NO FRIENDS?
1110 DATADOES THE SUBJECT OF FRIENDS DISTURB YOU?
1120 DATAWHY DO SOME PEOPLE HAVE LOTS OF FRIENDS?
1130 DATAIS MONEY THE ROOT OF EVIL?,WHY IS MONEY IMPORTANT TO YOU?
1140 DATAARE YOU FREQUENTLY SHORT OF MONEY?,DO YOU THINK YOU ARE POOR?
1150 DATADOES WEALTH BRING HAPPINESS?
1160 DATAONLY IF*,YOU DON'T SEEM SURE
1170 DATA"'GREAT' MEANING OF LARGE,FAMOUS OR GOOD?",WHAT DO YOU MEAN BY GREA
1180 DATADO YOU MEAN BIG*,"WOULD IT BE EXAGGERATING WHEN YOU SAY   GREAT*"
1190 DATACOMPUTERS CAN'T CONVERSE LIKE WE CAN,ARE YOU SCARED OF MACHINES?
1200 DATAWHY DO COMPUTERS SPRING TO MIND?,COMPUTERS ARE ONLY MACHINES
1210 DATACOULD A COMPUTER HELP YOU?,WHAT IS IT YOU FEAR FROM COMPUTERS?
1220 DATAWHAT FOOD DO YOU LIKE MOST?,WHY DO SOME PEOPLE OVEREAT?
1230 DATAWHAT ELSE BESIDES FOOD?,FOOD IS NECESSARY FOR LIFE
1240 DATAPLEASE DON'T TELL ME TO SHUT UP!,WHY DO YOU WANT ME TO SHUT UP?
1250 DATATHAT'S NOT VERY POLITE,WHY ARE YOU BEING SO AGGRESSIVE?
1260 DATA"THAT WILL BE TEN POUNDS,THANK YOU.       *NEXT PATIENT,PLEASE."
1270 DATA"THANK YOU FOR TALKING TO ME.             *NEXT PATIENT,PLEASE."
1280 DATAI WOULD LIKE TO HEAR MORE,GIVE ME A SPECIFIC EXAMPLE,I SEE
1290 DATATHAT IS FASCINATING,I UNDERSTAND,PLEASE CONTINUE,I DON'T UNDERSTAND
1300 DATACAN YOU ELABORATE ON THAT?,LET'S CHANGE THE SUBJECT
1310 DATA"WHY SUCH A LENGTHY REPLY?
1320 DATA"PLEASE KEEP YOUR REPLIES BRIEF"
1330 DATAWHY DO YOU REPEAT YOURSELF?,YOU JUST SAID THAT
1340 DATAPLEASE DON T KEEP SAYING THE SAME THING
1350 REM**POINTERS TO REPLIES**
1360 DATA1,5,1,5,6,4,10,5,15,5,20,3,23,3,26,4,30,2,32,2,34,3,37,3,40,3,43,3
1370 DATA43,3,43,3,43,3,43,3,43,3,43,3,51,4,55,4,60,4,55,5,63,3,66,5
1380 DATA71,6,77,6,83,3,86,3,89,4,93,5,98,4,102,5,107,2,109,4,113,6
1390 DATA119,4,123,4,127,2,127,2,129,9,138,2,140,2
READY.
```

TRS-80 Screen Dump

by C Ridley

For users of the TRS-80 Model 1 Level 2 with the Tandy Line Printer VII this program should provide a useful additional function.

It allows the user to obtain a straight copy of the screen by pressing shift '@'.

```
10 '    *** SCREEN DUMP TO LINE PRINTER ***
30 '        BY COLIN RIDLEY  13-10-81
40 DATA
CD,E3,03,FE,60,C0,00,3C,3E,0A,CD,3B,00,2A,06,7F
60 DATA
06,10,0E,40,CD,35,7F,7E,FE,20,FC,32,7F,FE,7F,F4
70 DATA
32,7F,CD,3B,00,23,0D,20,EE,3E,0A,CD,3B,00,05,20
80 DATA
E1,C9,3E,20,C9,C5,0E,08,3E,20,CD,3B,00,0D,20,F8,C1,C9
90 FOR ADDR=32512 TO 32577
100 READ HEX$:GOSUB 150
110 POKE ADDR,DEC:NEXT ADDR
120 POKE 16435,195:POKE 16436,0:POKE 16437,127:POKE 16405,0
130 NEW
150 N=ASC(HEX$)-48:IF N>9 THEN N=N-7
160 DEC=N*16
170 N=ASC(RIGHT$(HEX$,1))-48:IF N>9 THEN N=N-7
190 DEC=DEC+N:RETURN
```

PET Boxes

by Victor Russell

Boxes is actually made up of three games — Boxes, Knight and Ladder. All three are instructive, entertaining and 'user-proof'. They could easily be useful for demonstrations at club meetings, etc.

The program is not well annotated so splitting the program into its three component games would not be very easy. Full instructions for each game are included in the program. As it is so long a good deal of RAM will be needed — at an educated guess about 32k. Boxes was written in Basic 2.0.

```
1 POKE144,49
2 DATA39,117,78,255,40,41,123,77,127,-1,-41,-123,77,127,1,-39,-117,78,255,-40
3 DEFFNP(J)=PEEK(K+(40*(-1)*IJ+(-1)*(INT(J/2)))*HD
4 DEFFNR(I)=INT(RND(1)*10)+48
5 DIMAX(3),BX(3),CX(3),DX(3),FX(3):FORJ=0TO3:READAX(J),BX(J),CX(J),DX(J),FX(J)
6 NEXT L=33250:B=128:F=160:U=59468:GOTO300
7 FORZ=0TO999:NEXT:RETURN
8 POKEK,(BORPEEK(K))*(VAND1)+P*(V+1AND1):RETURN
9 GETA$:IFA$=""THEN9
10 V=ASC(A$):W=VAL(A$):V=(V-W-1)/2+(W-3):RETURN
11 POKEK,PEEK(K)ORB:RETURN
14 FORJ=0TO3:POKEK+AX(J),P:POKEK+FX(J),P:NEXT:RETURN
22 FORJ=0TO4:GOSUB11:POKEK+1,105:POKEK-40,233:K=K-39:NEXT
```

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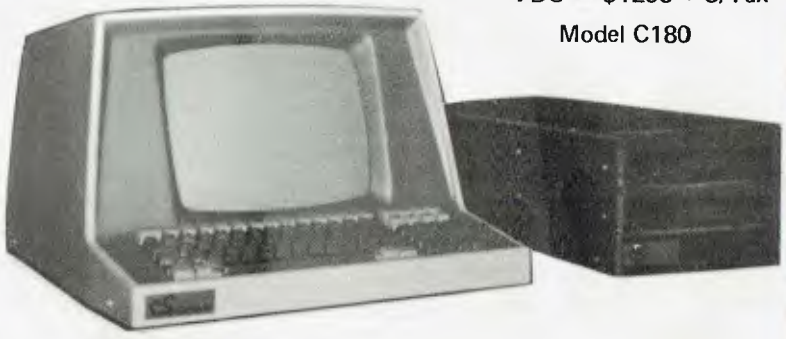
Model C180



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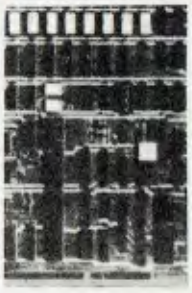

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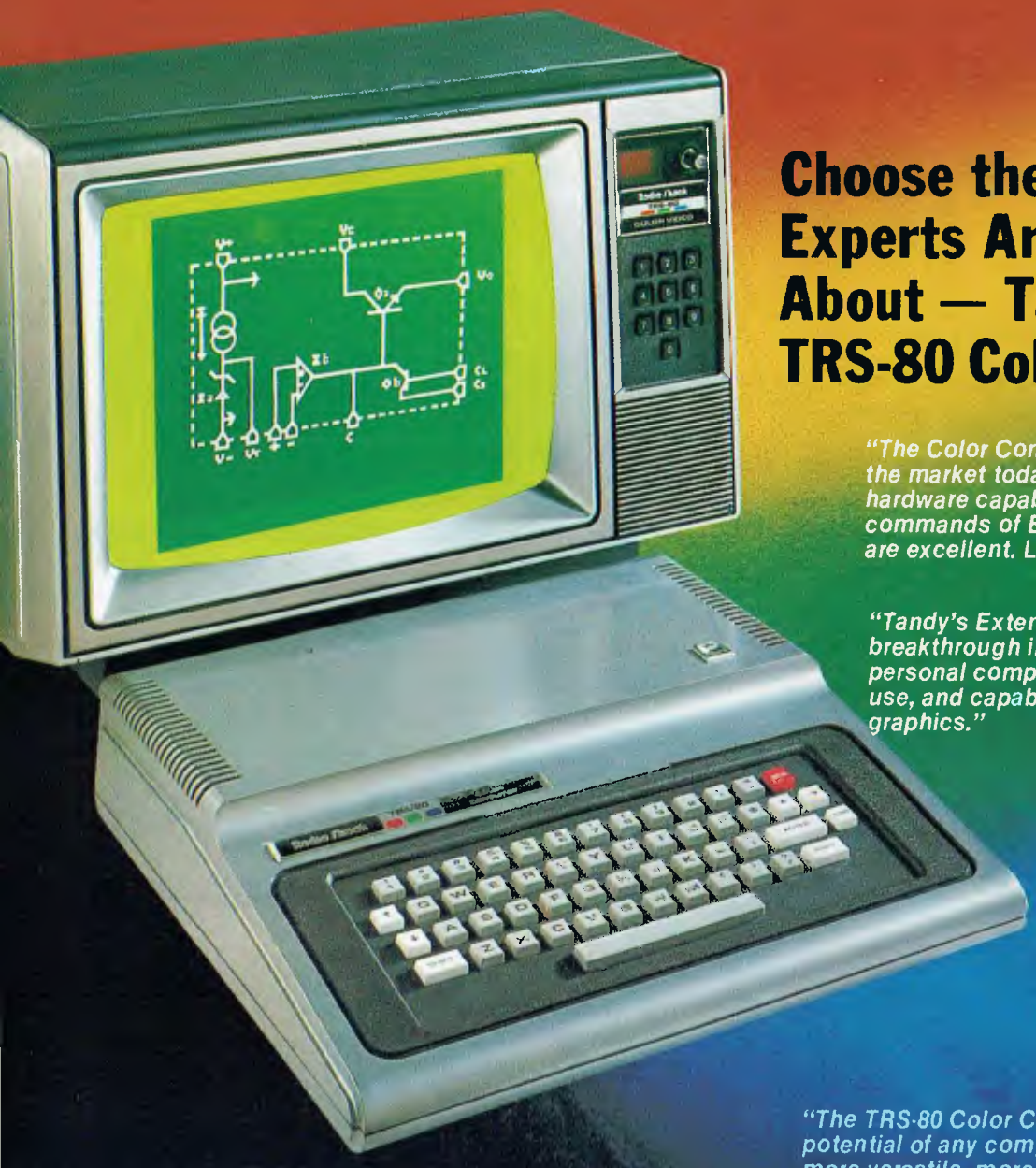

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```
23 IFPEEK(K)>60THENRETURN
24 S=S+PEEK(K)-48:GOSUB11:RETURN
26 FORJ=0TO4:GOSUB11:POKEK+1,223:POKEK+40,95:K=K+41:NEXT
27 IFPEEK(K)>60THENRETURN
28 S=S+PEEK(K)-48:GOSUB11:RETURN
30 FORJ=0TO4:GOSUB11:POKEK-1,233:POKEK+40,105:K=K+39:NEXT
31 IFPEEK(K)<99THENGOSUB8
32 RETURN
34 FORJ=0TO4:GOSUB11:POKEK-1,95:POKEK-40,223:K=K-41:NEXT
35 IFPEEK(K)<99THENGOSUB8
36 RETURN
44 GOSUB11:FORJ=0TO1:K=K+A%(V):POKEK,D%(V):NEXT
45 K=K+A%(V):S=S+(PEEK(K)-48)*(VAND1):GOSUB8:RETURN
55 PC=P:N0=0:GOSUB7:IFI>9THEN59
56 IFPEEK(Y+2*I)<60THENW=I:GOTO62
57 FORZ=1TOI:IFPEEK(Y+2*Z)<60THENW=Z:Z=I :NEXT:GOTO62
58 NEXTZ:PRINT"  CAN'T MOVE:  YOU"; N0=1:RETURN
59 W=INT(RND(1)*9+1)
60 IFRND(1)<IQTHENIFI<>INT(I/10)*10THENW=I-10*INT(I/10)
61 IFPEEK(Y+2*W)=PTHEN55
62 IFTGTHENPOKEY+2*W,P
63 PRINT"Y TURN:   CHOOSE"W".
64 C=C+W:RETURN
66 GOSUB7:PRINT" OUR  TURN          "; PC=102
67 IFI>9THEN70
68 FORZ=1TOI IFPEEK(X+2*Z)<60THENZ=I:NEXT:GOTO70
69 NEXT:PRINT"":PRINT" OU CAN'T MOVE: .", N0=I:RETURN
70 GOSUB9:IFQ<49ORQ>57THEN70
71 IFPEEK(X+2*W)>60ORC+W>KTHEN70
72 IFTGTHENPOKEX+2*W,PC
73 PRINTA$"." C=C+W RETURN
77 IFPEEK(M+A)=93THENGOSUB88:I=4 RETURN
78 M=M+A:POKEM,PC RETURN
88 FORH=0TO2 M=M-40 POKEM,PC NEXT A=-A M=M+A POKEM,PC RETURN
99 I=K-C IFD+1AND1THENGOSUB55
100 IFDAND1THENGOSUB66
101 RETURN
120 PRINT"   ":PRINT"OVE LIKE A KNIGHT AT CHESS, USING EVEN
125 PRINT"NUMBERED KEYS: THE FIRST NUMBER GIVES
130 PRINT"THE DIRECTION OF THE 2-SQUARE MOVEMENT:
135 PRINT"E.G 8 6 MOVES 2 SQUARES UP AND 1 TO THE  RIGHT.
140 PRINT"BJECT  GET AS CLOSE TO THE TARGET AS   POSSIBLE IN 7 MOVES.
142 PRINT"RESS  PLEASE, OR  FOR ALTERNATIVEGAME (COVER SQUARES).
145 TG=1 GOSUB9 IFQ=32THEN150
146 TG=0:IFQ<>65THEN145
150 POKEU,12 G$="         "
160 PRINT"" FORI=0TO4 FORJ=0TO8 PRINTG$; POKE32809+3*J+120*I,FNN(0):NEXT
170 PRINT"" NEXT K=33061 POKEK,P GOSUB14 S=0 A=0
180 IFTGTHENM=INT(30*RND(1)+20) PRINT"TARGET"M"
190 GOSUB9 J=W/2-1 IFINT(J)<>JORJ<0THEN190
200 PRINTA$"  "; H=6*F%(J)
210 GOSUB9 W=W/2-1
215 IFINT(W)<>WORW<0ORW=JORW=1ANDJ=2ORW=2ANDJ=1ORABS(W-J)=3THEN210
220 PRINTA$"" H=H+3*F%(W) IFPEEK(H+K)<48ORPEEK(H+K)>57THEN190
230 GOSUB11 K=K+H GOSUB14 S=S-48+PEEK(K) A=A+1 IFTGANDA=7THEN260
235 FORJ=0TO3STEP3 FORW=1TO2 H=PEEK(K+6*F%(J)+3*F%(W))
237 IFH>47ANDH<58THENJ=3 W=2 NEXT NEXT GOTO190
245 NEXT NEXT FORJ=1TO2 FORW=0TO3STEP3 H=PEEK(K+6*F%(J)+3*F%(W))
247 IFH>47ANDH<58THENJ=2 W=3 NEXT NEXT GOTO190
250 NEXT NEXT PRINT"BOXED IN !" PRINT44-A"LEFT UNCOVERED." GOTO290
255 GOTO190
260 I=ABS(S-M) PRINT"TOTAL ="S"  SO YOU LOSE"I"POINTS.
270 I=50-I IFMK<ITHENMK=I
280 PRINT"SCORE ="I".   BEST SCORE ="MK".
290 PRINT"PRESS SPACE .
295 GOSUB9 IFQ=32THEN150
296 IFQ<>13THEN295
300 PRINT POKEU,14:PRINT"OR    , PRESS  ." PRINT"OR    ,   .
320 PRINT"OR L   ,   L." PRINT" O END PROGRAM,   .
330 PRINT"ETURN TO THIS INDEX BY PRESSING  
335 PRINT"INSTEAD OF  AT THE END OF A GAME.
340 GOSUB9 IFQ=76THEN1990
350 IFQ=69THENPRINT"" POKE144,46:POKE59468,12:END
355 IFQ=75THEN120
360 IFQ<>66THEN340
400 PRINT:PRINT""; POKEU,14:PRINTTAB(15)"_____" PRINTTAB(15)"    
     
405 S=0:PRINT"SE NUMBER KEYS 1,3,7 & 9 TO MOVE
410 PRINT"7 MOVES UP AND LEFT ETC.
425 PRINT" OU SCORE ONLY WHEN MOVING LEFT TO RIGHT";
430 PRINT"(USING KEYS 3 OR 9).
435 PRINT"    GET A TOTAL AS CLOSE AS" PRINT"POSSIBLE TO THE TARGET.
445 PRINT" AXIMUM POSSIBLE SCORE IS 50.
446 PRINT"      SIMPLY SCORE AS MUCH  AS POSSIBLE.
460 PRINTTAB(5)"RESS L FOR LARGE VERSION," PRINTTAB(11)" FOR SMALL.
470 GOSUB9 IFQ=76THEN980
475 IFQ<>83THEN470
480 PRINT"OVE FROM WHITE SQUARE TO FLASHING BALL.
481 PRINT" OU MAY PASS THROUGH A BOX TWICE (NOT
482 PRINT"CHANGING YOUR SCORE), BUT NOT ALONG THE SAME PATH TWICE.
484 PRINT"RESS , OR  FOR ALTERNATIVE GAME.
485 GOSUB9:IFQ=32THENTG=-1:GOTO490
486 TG=0:IFQ<>65THEN485
490 POKEU,12 PRINT"" FORI=1TO5 FORJ=0TO(I>2)*(I-6)-(I<3)*I
500 PRINTTAB(5*ABS(I-3)+J*10)G$; NEXT PRINT IFI<5THENPRINT"
540 NEXT PRINT"" TAB(8)U$W$U$W$ PRINT"" PRINTTAB(3)U$W$U$W$U$W$
560 PRINT PRINTTAB(3)W$U$W$U$W$U$ PRINT"" PRINTTAB(8)W$U$W$U$
650 FORI=1TO2 FORJ=-1TO1 POKEL+10*I+400*J,FNN(0) NEXT NEXT
660 FORI=0TO2 POKEL+5+I*10+200,FNN(0) POKEL+5+I*10-200,FNN(0) NEXT
670 PRINT Z=INT(RND(1)*40)+10:IFTGTHENPRINT"TARGET"Z
680 PRINT PRINT"" TAB(32)""; POKE167,0 K=L POKEK,P
710 FORJ=-1TO1 IFPEEK(K+40+J)=32ORPEEK(K-40+J)=32THENJ=1 NEXT GOTO715
712 NEXT POKE167,1 PRINT"YOU ARE  " PRINT"BOXED IN !" PRINT""; I=0 GOTO765
715 GOSUB9 IFW<>1ANDW<>3ANDW<>7ANDW<>9THEN715
720 IFPEEK(K+A%(V))<>32THEN715
730 ONV+1GOSUB30,26,34,22
735 IFK=33280THEN746
740 GOTO710
746 I=50-ABS(S-Z) POKE167,1 PRINT IFNOTTGTHEN750
748 PRINT"TOTAL="S PRINT"__________" PRINT"SCORE="I"" IFI>MTTHENMT=I
749 I=MT GOTO765
750 IFS>MXTHENMX=S
760 I=MX PRINT"SCORE ="S,
```

PROGRAMS

```
765 PRINTTAB(28)"BEST SCORE" PRINTTAB(30)"I3"I"■.
770 PRINTTAB(28)"■PRESS ■SPACE■
780 GOSUB9:IFO=13THEN300
785 IFO<>32THEN780
790 S=0:GOTO490
800 PRINT"□■OVE FROM WHITE SQUARE TO ANY OF THE■
805 PRINT"THREE RIGHT-HAND SQUARES.■■■
807 G$=" □▌■■□ " R$="■■■" U$="／□■" W$="＼■■
810 PRINT" YOU MAY NEITHER GO THROUGH THE SAME BOX■
811 PRINT"NOR ALONG THE SAME PATH TWICE.■■■■


992 PRINT"□RESS ■◆□↑□■ OR 0 (OR PRESS ONE OF■
993 PRINT"THESE KEYS WHILE HOLDING DOWN A ■◆ F.←I ■■
994 PRINT"KEY FOR THE ALTERNATIVE GAME).
995 GOSUB9:TG=(O>99) IFO=32ORO=PTHEN999
996 IF(OORB)<>215THEN995
997 G$=" □ ■■■ □ "
999 PRINT"□" POKEU,12
1000 FORI=1TO3:FORJ=1TO5:PRINTR$G$,:NEXT:PRINT:PRINT:PRINT"■■■";
1010 FORJ=1TO6:PRINTU$W$,:NEXT:PRINT
1020 FORJ=1TO7:PRINTG$R$,:NEXT
1030 FORJ=1TO6:PRINTW$U$,:NEXT:PRINT:PRINT
1040 NEXTI:FORJ=1TO6:PRINTR$G$,:NEXT
1060 FORI=0TO3:FORJ=0TO5:POKE32812+6*J+240*I,PNN(0):NEXT:NEXT
1070 K=32929:FORI=0TO2:FORJ=0TO6:POKEK+6*J+240*I,PNN(0):NEXT:NEXT
1080 K=K+240*INT(RND(1)*3):POKEK,P
1085 IFNOTTGTHENZ=30+INT(70*RND(1)):PRINT:PRINTTAB(14)"■*TARGET"Z"■■□"
1090 GOSUB9:IFW<>1ANDW<>3ANDW<>7ANDW<>9THEN1090
1100 IFPEEK(K+BX(V))<99ANDPEEK(K+AX(V))=CX(V)THENGOSUB44
1140 FORJ=0TO2 IFK=32965+240*JTHENJ=2:NEXT:GOTO1185

1150 NEXT:J=0
1160 H=3:IFJ=4THEN1260
1170 IFFNP(J)>32ANDFNP(J)<60THENH=1:IFFNP(J)=78ORFNP(J)=77THEN1090
1180 J=J+1:GOTO1160
1185 IFTGTHEN1200
1190 I=50-ABS(2-S):PRINT"■■ TOTAL="S" ";TAB(27)"■SCORE ="I"■■.
1195 IFI>M2THENM2=I
1196 PRINT"■■■■TOP SCORE ="M2".■■■";:GOTO1230
1200 PRINT:PRINT:PRINT"SCORE ="S".";
1210 IFS>MLTHENML=S
1220 PRINT"■■■TOP SCORE ="ML"■■.■
1230 PRINTTAB(10)"PRESS ■SPACE■.";
1240 GOSUB9:IFO=13THEN300
1245 IFO<>32THEN1240
1250 S=0:GOTO999
1260 PRINT:PRINT:PRINT"BOXED IN !■":GOTO1230
1990 PRINT"□■◆□↑□■□■■■":PRINT"OR TAKE IT IN TURNS TO CHOOSE A NUMBER:■
1992 PRINT"FIRST TO REACH THE TARGET WINS.■■■
1993 PRINT"□RESS ■◆□↑□■ PLEASE, OR A NUMBER TO SET ■MY INTELLIGENCE.
1994 PRINT"■■■OR ALTERNATIVE, WHERE WE CAN'T RE-USE■
1995 PRINT"NUMBERS, PRESS ONE OF THESE KEYS WHILE ■HOLDING DOWN ■◆ F.←I ■■.
1996 TG=0:GOSUB9:IFO>159THENTG=1:W=VAL(CHR$(O-B0))
1997 IFO=PORO=32THENIQ=1-.2*TG:GOTO2000
1999 IQ=W/10


2000 G$="┌─┐■■■■H■■└─┘■■└┘" U$="┌─┐■■■■■■■■└─┘■■└┘"
2010 C=0:R$="┌─┐■■■■H■■└─┘■■■■■■■■└─┘■■└┘" W$="┌─┐■■■■■■■■└─┘■■└┘"
2500 TN=TN+1AND1 D=TN:PRINT"□┌─┐■■■■■■■■└─┘■■└┘"; FORJ=1TO8:PRINTG$;:NEXT
2600 PRINT"┌─┐■■■■H■■└─┘■■■■";
2800 FORI=1TO2:PRINTU$;:FORJ=1TO8:PRINTG$;:NEXT:PRINT"┌─┐■■■■H■■└─┘■■■■";
2810 PRINTW$;:FORJ=1TO8:PRINTG$;:NEXT:PRINTR$;:NEXT:PRINT"■■■■■■ ■■";
3000 FORJ=4TO0STEP-1 K=JAND1 V=J+1AND1:FORI=10TKTO10:WSTEPV-K
3050 PRINT"■"RIGHT$(STR$(J*10+I),2)"■";:NEXT:PRINT"■■";:NEXT:PRINT"□
3060 X=33528:IFTGTHENPOKEX,102:FORJ=1TO9:POKEX+J*2,48+J:POKEX+80+J*2,48+J:NEXT
3100 K=20+INT(RND(1)*31):PRINTTAB(9)"■ ↑←↓→"K"■":Y=X+80:IFTGTHENPOKEY,P
3150 A=1 M=33288:GOSUB99:FORI=1TO2:GOSUB77:NEXT:IFW=1THEN3350
3160 FORJ=1TOW-1:FORI=1TO4:GOSUB77:NEXT:NEXT:GOTO3350
3200 GOSUB99:IFN0THEN3400
3270 FORJ=1TOW:FORI=1TO4:GOSUB77:NEXT:NEXT
3350 D=D+1:IFC=KTHEN3380
3360 GOTO3200
3380 IFDAND1THENPRINT".";
3390 IFD+1AND1THENPRINT" OU"
3400 PRINT" HAVE WON  PRESS ■◆□↑□■.
3450 GOSUB9:IFO=32THEN2000
3500 IFO<>13THEN3450
3550 GOTO300
```

Atari Earth

by Martin Stiby

This is a two player game with a difference, in that each player has a completely different role within the game rather than both players doing the same thing and vying for the higher score. One player controls an alien and the other a satellite which has to ram the alien and destroy it. The concept behind the game is that our planet is being threatened (as always) by the alien who wants to vaporise all of us. The satellite has a time limit in which to vanquish the invader.

Earth is displayed on the screen and both players can hide behind it, although this affords little in the way of protection. Full instructions are provided on request by the program.

To vary the amount of acceleration on both alien and satellite, the value of M in line 545 can be altered. The '{' in lines 10,40 and 3015 is a clear screen symbol and any text to be printed in lines 400, 2000 and 3015 is in inverse video.

```
10 PRINT "{Doest thou require knowledge
      concerning the use of this prog
ram ?":POKE 764,255
20 IF PEEK(764)=255 THEN 20
30 IF PEEK(764)=35 THEN 490
```


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World War III 40k Disk
Stone of Sisyphus 40k Disk
Adventures 1 to 12 (all 24k Tape)
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Rescue at Rigel 32k Tape
Dragon's Eye 32k Tape
Jawbreaker (Full Play/Miss) Disk
Maze of Death 16k Tape
The Quest 24k Tape
Maze Encounter (3D Graph) 16k Disk
Sammy the Sea Serpent 16k Tape
Streets of the City 24k Tape
Star Trek 3.5 32k Tape
Galactic Trader 24k Tape
Alpha Fighter 16k Tape
Giant Slalom 16k Tape
Space Tilt 24k Tape
Flight Sim. (No Graphics) 16k Tape
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Escape from Volantium 16k Tape
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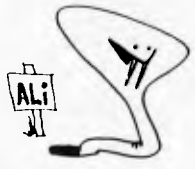

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SYSTEM 80 INTERNAL MEMORY

PROGRAMS

```
40 PRINT "}  We are being threatened by
an alien":PRINT "intelligence, which is
going to"
30 PRINT "vaporize Earth unless we can r
am it":PRINT "with a remotely-controlled
 satellite"
60 PRINT "which just happens to be up th
ere !":PRINT " There is a time limit aft
er which"
70 PRINT "there is no hope for us !":PRI
NT "  The left hand joystick controls th
e"
80 PRINT "alien and the right hand joyst
ick":PRINT "controls the satellite."
90 PRINT " Both players may hide behind
the":PRINT "Earth, at their own peril !!
":PRINT
400 PRINT "          ANY KEY TO START":PO
KE 764,255
401 IF PEEK(764)=255 THEN 401
490 DIM HC(15),VC(15):GRAPHICS 7:SETCOLOR
2,3,0:SETCOLOR 0,8,2:SETCOLOR 1,8,8
500 DEG :COLOR 2:FOR A=5 TO 90 STEP 2.95
:X=SIN(A)*30:Y=COS(A)*20:PLOT X+80,Y+40:
DRAWTO 80-X,Y+40
510 PLOT X+80,40-Y:DRAWTO 80-X,40-Y:NEXT
 A:PLOT 50,40:DRAWTO 110,40:COLOR 1:PLOT
 80,60
520 FOR B=26 TO 5 STEP -7:FOR A=0 TO 360
 STEP 20:DRAWTO SIN(A)*B+80,COS(A)*20+40
:NEXT A:NEXT B
530 RAM=PEEK(106)/2+2:FOR A=1536 TO 1620
:READ B:POKE A,B:IF B=34 THEN POKE A,RAM
531 NEXT A
540 DATA 162,120,169,0,157,3,34,202,208,
250,162,50,169,24,157,3,34,157,7,34,169,
60,157,4,34,157,6,34,169,231
541 DATA 157,5,34,104,96,162,120,169,0,1
37,131,34,202,208,250,162,50,169,16,157,
131,34,169,24,157,132,34,157
542 DATA 137,34,169,60,157,133,34,157,13
6,34,169,127,157,134,34,169,254,157,135,
34,169,8,157,138,34,104,96
545 M=0.15:FOR A=1 TO 15:READ B:HC(A)=B*M
:READ B:VC(A)=B*M:NEXT A:POKE 752,1
546 DATA 0,0,0,0,0,0,0,0,0,1,1,1,-1,1,0,0,
0,-1,1,-1,-1,-1,0,0,0,0,0,1,0,-1,0,0
550 POKE 54279,RAM-2:POKE 559,46:POKE 53
277,2:POKE 623,4:HE=53248:HG=53249:POKE
704,88:VE=1547:POKE HE,0
560 POKE HG,0:POKE 705,198:VG=1582:CHE=5
0:CHG=180:SPHE=0:SPHG=0:SPVE=0:SPVG=0:CV
E=50:VME=1536:VMG=1571:CVG=50
570 HIT=53281:RL=200:LL=48:TIME=500:PRIN
T "}TIME":POKE 53278,0
1000 S=STICK(0):SPHE=SPHE+HC(S):SPVE=SPVE
+VC(S):IF CHE+SPHE>RL OR CHE+SPHE<LL THEN
 SPHE=0
1201 IF SPVE+CVE>88 OR SPVE+CVE<1 THEN S
PVE=0
1220 CHE=CHE+SPHE:POKE HE,CHE:CVE=CVE+SP
VE:POKE VE,CVE:X=USR(VME)
1500 S=STICK(1):SPHG=SPHG+HC(S):SPVG=SPVG
+VC(S):IF CHG+SPHG>RL OR CHG+SPHG<LL THEN
 SPHG=0
1701 IF SPVG+CVG>85 OR SPVG+CVG<1 THEN S
PVG=0
1720 CHG=CHG+SPHG:POKE HG,CHG:CVG=CVG+SP
VG:POKE VG,CVG:X=USR(VMG)
1750 S=ABS(SPVE)+ABS(SPHE):SOUND 0,S*3,8
,S+5:S=ABS(SPVG)+ABS(SPHG):SOUND 1,S*3+4
8,8,S+5
1800 PRINT TIME;"  ":TIME=TIME-1:IF TIME
=0 THEN 3000
1900 IF PEEK(HIT)<>0 THEN 3000
1998 GOTO 1000
2000 PRINT "}OH DEAR THE EARTH HAS BEEN
VAPORIZED":SOUND 1,0,0,0:FOR A=1 TO 10:M
=RND(1)*16:FOR B=20 TO 60 STEP 2
2009 SETCOLOR 4,M,(B-20)*0.375:SOUND 0,B
,10,15:NEXT B:NEXT A:SETCOLOR 4,0,0:FOR
A=30 TO 1 STEP -2:SOUND 0,A,8,15
3010 FOR B=1 TO A:NEXT B:NEXT A:SOUND 0,
0,0,0:SETCOLOR 0,0,0:SETCOLOR 1,0,0:SETC
OLOR 2,10,8:GOTO 3020
3000 SOUND 1,0,0,0:SOUND 0,99,8,15:FOR A
=1 TO 10:POKE 704,14:POKE 705,14:FOR B=1
 TO 30:NEXT B:SETCOLOR 4,A,5
3010 POKE 704,0:POKE 705,0:FOR B=1 TO 30
:NEXT B:SETCOLOR 4,0,0:NEXT A
3015 PRINT "}     EARTH IS SAVED : WELL
DONE":SOUND 0,0,0,0
3020 PRINT :PRINT " Do you want to play
again ?":POKE 764,255
3030 IF PEEK(764)=255 THEN 3030
3040 IF PEEK(764)=43 THEN SETCOLOR 0,8,2
:SETCOLOR 1,8,8:SETCOLOR 2,3,0:B=0:GOTO
550
3050 POKE 764,255:POKE 53277,0:POKE 5336
5,0:GRAPHICS 0:END
```

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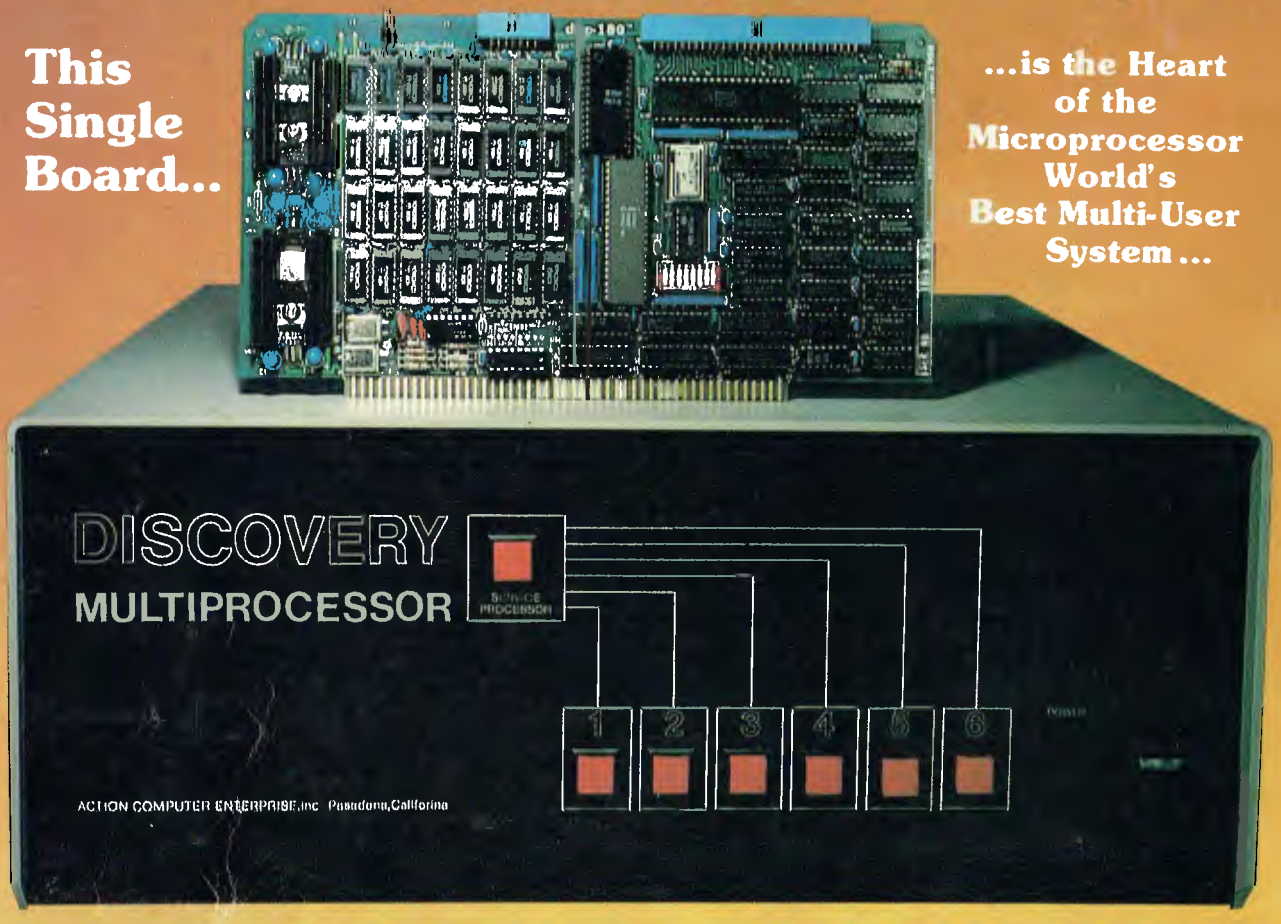

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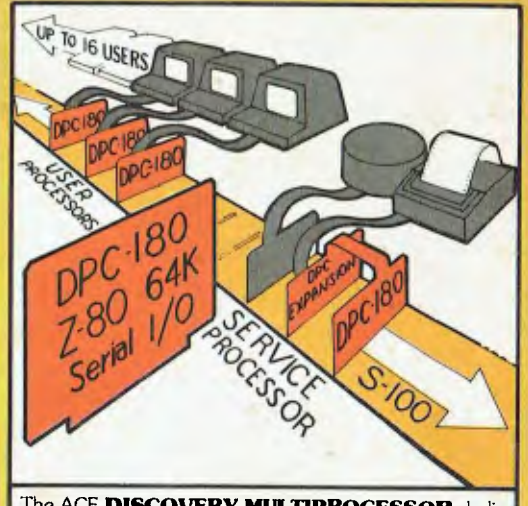

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